ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA

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Submitted By

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Dedicated

to

my Family

&

Teachers

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Dr. Amanpreet Kaur Sekhon

LIST OF ABBREVIATIONS

MRI	: Magnetic resonance imaging
CT	: Computed Tomography
EAUS	: Endo anal ultrasonography
FOV	: Field of view
DW-MRI	: Diffusion-weighted magnetic resonance imaging
T1W	: T1 weighted images
T2W	: T2 weighted images
T2 FS	: T2 fat-saturated MRI
IO	: Intraoperative
CE-T1WI	: Contrast-enhanced T1 weighted image
PAF	: Perianal fistula
TS	: Trans sphincteric fistula
ES	: Extra sphincteric fistula

KEYWORDS

Perianal fistula

Fistula in ano

Magnetic resonance imaging

Primary tract

Internal opening

Perianal fistula grading

ABSTRACT

INTRODUCTION: Perianal fistula is an uncommon process, with a prevalence of 0.01%. It predominantly affects young males, with male-to-female ratio of 2:1. Most commonly, it presents with discharge and local pain due to inflammation. Although surgery is the definite treatment of perianal fistula, successful surgical management depends upon an accurate preoperative assessment of the location of the track, internal opening, abscess formation or secondary track formation.

MRI owing to its high soft tissue resolution and multiplanar imaging capability allows accurate assessment of the perianal fistula and also gives information regarding anatomical relations between the fistula and anal sphincter complex. Thus, it is the gold standard and the best investigation for preoperative assessment of perianal fistula.

AIM OF STUDY:

1. To evaluate the role of MRI in the assessment of perianal fistula and its correlation with per-operative findings.
2. To compare the predictability of different MRI sequences.

MATERIALS AND METHODS: A prospective study of 50 patients (40 males and10 females; age range: 20-71 years) who were referred for MRI perineum for perianal fistula to the Department of Radio-diagnosis, Dayanand Medical College & Hospital, Ludhiana for a period of one and half year.

CLINICAL SIGNIFICANCE: To assess the perianal fistula, improve its overall surgical outcome and reduce morbidity, recurrence and post-op complications such as fecal incontinence.

RESULTS: Out of 50 patients, diagnosed with perianal fistula, it was most common in 41-50 age group with male to female ratio of 4:1. Symptoms included pain (96%), discharge (76%), and swelling (44%). Imaging findings showed that most of the internal opening locations were at 6'o clock and 12'o clock. We compared different sequences to detect perianal fistula. DWI was best at detecting abscesses, horseshoe complexes. And supra levator extensions. T2 weighted with T2 fat suppression (T2FS) was the most efficient for diagnosing 1^0 and 2^0 fistulous tracts and internal openings. T1 weighted post-contrast images showed comparable accuracy to T2FS.

CONCLUSION: The study concluded that MRI is the ideal imaging modality for delineating the perianal fistula due to its high sensitivity and specificity.

It offers detailed anatomical information and can accurately diagnose and classify the condition, reducing the need for additional studies. Additionally, it is inferred that contrast studies could be excluded for cases that were previously untreated as there is not much additional information provided by the contrast images.

KEYWORDS: Perianal fistula, Fistula in ano, Magnetic resonance imaging Primary tract, Internal opening, Perianal fistula grading

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INTRODUCTION

A perianal fistula is defined as an abnormal connection between the anal canal and the surrounding skin of the perineal region. Most commonly it presents with discharge (65% of cases) and local pain due to inflammation.[1]

Fistula is commonly encountered in routine surgical practice and is associated with a high recurrence rate. The perianal fistula incidence ranges from 1-2 per 10,000 individuals with males being more susceptible than females at a ratio of 2:1. It causes considerable morbidity in young and middle-aged people.[2]

From the days of Hippocrates, muscular rings responsible for continence were well known to exist around the anal canal. This topic gained particular attention in the 19th century. German and French anatomists gave much more accurate descriptions in the late nineteenth century. The concept of anorectal ring (anatomically the puborectalis muscle) was introduced in 1934 by Milligan and Morgan and classified the fistulas passing above or below this structure. The classification of the fistulas was refined by other authors. Around 1958, Eisenhammer laid emphasis on the pathogenesis and spread of fistulas in the intersphincteric plane, and in 1950, Steltzner classified fistulas into three groups: intermuscular (between external and internal sphincter), transphincteric, and extrasphincteric. In 1968, Lilius further described its upward extension with the involvement of the rectal wall. The classification in use today, known as Park's classification, was given in the 1960s, after studying the perianal fistulas in 400 treated cases in 15 years, and four types were illustrated.[3-4]

Management of the fistula depends on a number of factors and a thorough evaluation of clinical findings to establish the most suitable approach, be it medical or surgical, with most cases requiring surgical intervention. An

insufficient evaluation of the fistula combined with its inaccurate description may convert a simple fistula into a complicated one. Recurrence generally occurs when the infection escapes surgical detection and is left untreated.

Failure to appreciate complex ramifications can lead to recurrent sepsis and a needlessly extended medical trajectory, prolonging patient suffering and complicating treatment outcomes. Thus, before the surgical approach, an accurate pre-operative evaluation of the fistula using imaging methods to delineate its path, the extent of the disease (including horseshoe extension), its associated findings such as an abscess, and secondary ramifications are of utmost importance to attain surgical success and avoid recurrence. [2]

ANATOMY

The definition of the anal canal is that it is the terminal part of the large intestine, lying between the rectum above and the anal verge in the perineum below.

The anatomical term, the anal verge, is the opening surrounded by perianal skin overlying the external sphincter in its subcutaneous part and is used as a reference point for anorectal structures.

The anorectal junction is the point where the puborectalis muscle arises from the body of the pubic bone, forms a U shape sling posteriorly, forming a demarcation between the anal canal and the rectum.[5-6]

Although the dentate line is not directly visualized on Magnetic resonance imaging (MRI).On colonoscopy and physical examination correlation, it was affirmed that the dentate line/ pectinate line is the junction point of ectoderm and endoderm that lies midway along the anal canal at the muscular plane level between the deep and superficial external anal sphincter.

The anatomic anal canal is the term used for the anal canal distance from the anal verge to the dentate line. It measures 2.1 cm.[6-7]
Hence on 3 Tesla MR, the length of the anal canal is measured from the anorectal junction at the puborectalis sling level to the tip of the subcutaneous aspect of the external sphincter. The mean length of the anal canal measures 4.4 cm.[8]

The anal sphincter complex comprises a group of muscles surrounding the anal canal. The inner involuntary thick muscular layer is the internal anal sphincter extending from the smooth muscle layer of the rectum, and the outer skeletal voluntary muscle layer is the external anal sphincter.[9]The internal sphincter terminates just before the lowermost part of the external sphincter. It appears homogenously hyperintense on T2 weighted images (T2W), showing post-contrast enhancement, whereas the external sphincter appears hypointense with a striated appearance and it does not enhance much on post-contrast images.[8]

The external anal sphincter is divided into three parts: subcutaneous, superficial and deep part. The subcutaneous part acquires a J-shaped configuration, lying beneath the perianal skin.[9] The superficial part constitutes the majority of the anal sphincter, and the deep part encompasses the upper third of the anal canal and joins the puborectalis sling. Intersphincteric space appears hyperintense on T1 and T2 and composes of anal glands in the intersphincteric plane.[4,6]

ETIOLOGY

Fistulas are most commonly idiopathic and caused by chronic infection of anal glands. Most perianal fistulas primarily occur due to infection in the anal gland, resulting in the formation of the fistulous tract and abscess. According to the cryptoglandular hypothesis theory, it occurs because of the obstruction of a draining duct located at the dentate line level in the

mid-anal canal, which results in the formation of a fistulous tract and abscess.[4]The cryptoglandular theory is not able to elucidate the development of an extra sphincteric fistula with a direct opening in the rectum or vagina with no anal canal involvement in the case of Crohn's disease. [10]

Chiari, in 1878, first described the anal glands. These glands are branched stratified columnar epithelial lined structures dispersed around the circumference of the submucosal layer of the anal canal, with ductal openings at the dentate level i.e., at the crypts of Morgagni base. Some of the branches penetrate the internal sphincter to reach the intersphincteric space and do not extend into the external sphincter. Infections may spread directly from the anal canal in any possible direction.

There are numerous secondary causes of perianal fistulas, which include several inflammatory conditions such as pelvic infection, Crohn's disease, diverticulitis, tuberculosis, trauma after radiation therapy, pelvic malignancy, and childbirth.[11]

The most common site of primary infections is the intersphincteric plane which results in the fistula or abscess formation. The most superficial fistulas directly drain into the anal canal spontaneously, but if the fistula involves the internal sphincter then the sphincter acts as a barrier, and the pus travels in the intersphincteric space reaching up to the skin surface. Pus can move on through the sphincter, crossing both its layers and leading to the formation of a transsphincteric fistula, resulting in inflammatory changes with or without abscess formation in the ischioanal fossa.

Evaluation of fistula

Diagnostic methods of imaging perianal fistulas include retrograde fistulography, endo anal sonography (EAUS), computed tomography (CT) fistulography, and magnetic resonance imaging (MRI).

In the earlier days, fistulography was conducted to study the anatomy of the fistula using X-ray imaging. It was a complicated procedure that involved the slow injection of contrast into the external opening to avoid any tissue disruptions. The slow injection of contrast may image the primary tract but it failed to fill any secondary extensions. This method was also not able to explain the perianal anatomy, making it difficult to determine the course or location of the tract. It is a highly invasive procedure, and the chances of sepsis are also high.[12-13]

Anal endosonography was also insufficient for clinical assessment of the perianal fistula as it was unable to recognize the deep-seated infection. Due to its limited field of view (FOV), it was difficult to follow the whole course of transsphincteric or suprasphincteric fistulas. It was also not possible to differentiate between the areas of fibrosis and infection, which is particularly important in cases of recurrent fistulas, as both appear hyperechoic on endosonography.[14]

Computed tomography, as a method of imaging fistulas also provides limited information. Through non-ionic water-soluble contrast inserted per rectum or through the external opening, it can identify the existence of fistulous tracks, but it is not accurate for a detailed analysis of fistulous anatomy to classify it. Moreover, it was difficult to characterize the sphincters, levator ani, and fibrous fistulous tract accurately because of their similar attenuation values.[15]

MRI is now increasingly recognized as an emerging technique to access the perianal fistula. Due to the use of non-ionizing radiation and high contrast resolution, it is widely used in the identification and diagnosis of

all types of fistulas. The procedure is preferential as it has 96% sensitivity and 100% specificity for primary fistula and internal opening identification. Complex fistula tracts, infected tracts, and abscess formations are also easily imaged with MR, with 100% sensitivity and specificity. [16]

Furthermore, it can provide comprehensive anatomic detail of the connection between the fistula and the anal sphincter complex. This thereby allows surgeons to correctly select the most pre-eminent surgical treatment roadmap to reduce the recurrence and post-surgery complications, such as faecal incontinence. [17-18]

MR imaging of perianal fistulas relies on the high contrast resolution of soft tissue and the multiplanar display of anatomy. Various studies have suggested that MRI is even more sensitive than the surgical exploration of the tract.

Hence, due to its accuracy, non-invasiveness, and the use of nonionizing radiation, it has become the primary choice of investigation for diagnosing and evaluating perianal fistulas.

Hence the main objective of the MRI is to answer the surgical questions before the intervention regarding the type of fistula, location of internal opening, presence of abscess formation, any possible secondary track formation, supralevator extension, and distance between internal opening and anal verge.

A new classification system proposed by St. James University Hospital with the advent of MRI describes the site of the internal opening with the reference of the anus as a clock on axial.[15]

Five grades are proposed:

Grade 1 -Simple intersphincteric fistula

Grade 2 -Intersphincteric fistula with abscess formation or secondary tract

Grade3 -Transsphincteric fistula

Grade4 -Transsphincteric fistula with abscess formation or secondary tract

Grade5 -Supra elevator and translevator disease

Park's classification is the most often surgical classification used nowadays. Park et al. meticulously scrutinized 400 patients treated for the past 15 years in the 1970s in St. Mark's Hospital, London, England. It assigned four groups to the fistula according to the relation to the external sphincter and its course. The four groups are as follow:

1. Intersphincteric fistula – involves the intersphincteric space and may reach the perineal skin through or medial to the subcutaneous external sphincter
2. Transsphincteric fistula passes through the external sphincter into the ischiorectal fossa
3. Suprasphincteric fistula travels upward into the intersphincteric space, passes over the top of the puborectalis muscle, then descends through the levator plate to the ischiorectal fossa and then to the skin
4. Extrasphincteric fistula travels outside the external sphincter space reaching up to the anal canal/ rectum through the ischiorectal fossa and levator ani complex[3]

Horseshoe is the term used when the fistulous tract is seen to horizontally cross the midline reaching the contra lateral side.
Supralevator extension is the tract crossing the levator plate reaching superior or medial to it.
Abscess is the term used for a fluid-filled structure more than 10 mm with peripheral enhancement and the presence of air foci within.[19]

The surgeon's description of the perianal fistulous tracks is by referring to the "anal clock", which is the anal region view with the patient in the lithotomy position. At 12'o clock is the anterior perineum, at 6'o clock refers to the natal cleft, 3'o clock is the left lateral aspect, and 9'o clock to the right of the anal canal. This description corresponds to the anal canal view on MR as well. [15]

The Management of perianal fistula depends on whether it's caused by Crohn's disease or otherwise, depending upon the complexity of the fistula and its recurrence. Medical and surgical management is done in cases of Crohn's disease to subside the inflammation. Definitive surgical options include fistulotomy, fistulectomy, seton placement, and mucosal flap placement.

A fistulotomy is also known as the lay-open technique. This procedure creates an incision in the fistula tract and opens it in the anal canal to drain. This procedure is generally used for intersphincteric fistula and low transsphincteric fistulas. This procedure is not done in patients with >20 % sphincter involvement or in women with anterior transsphincteric fistula as it can lead to incontinence.[16]

Fistulectomy creates a larger wound than fistulotomy because it is the complete excision of the tract.

Seton placement is done as an alternative to fistulotomy and fistulectomy to prevent recurrence, as seton placement prevents the closure of the external opening of the fistula, which allows the fistula to drain. Two types of setons are used: cutting setons or draining setons, with draining being more commonly used. They are tightened over months. On MRI images these appear hypointense on both T1 and T2 wt. images with best appreciation on the coronal section.

Complex fistulas are treated with mucosal flap placement. This procedure includes closing the internal opening and widening the external opening to drain the fistula.

Ligation of intersphincteric fistula tract (LIFT) is done for intersphincteric fistulas by incising the intersphincteric groove and removing the fistula. Biologic mesh can also be opted to put in this procedure to prevent the recurrence.

Mesenchymal adipose-derived stem cell/aliquots injection along the tract is under trial. Biochemical closure treatment includes fistula plugs and

glues injected along the tract. Laser ablation by specialized equipment is an emerging treatment.[2,20]

AIM AND OBJECTIVE

1. To evaluate the role of MRI in the assessment of perianal fistula and its correlation with per operative findings.
2. To compare the predictability of different MRI sequences

REVIEW OF LITERATURE

Al-Khawari H. A et al (2005) performed a prospective study to assess the role of magnetic resonance imaging (MRI) in preoperative assessment of fistula-in-ano. In this research study, a total of twenty-six patients (comprising 21 males and 5 females, with an age range of 19-65 years) were actively observed from July 1999 to December 2001 using a 1.0-tesla super conducting magnet. Various imaging techniques, including T1-weighted fast spin echo (T1W FSE) images before and after gadolinium injection, as well as fat-suppressed T2-weighted fast spin echo (T2W FSE) sequences, were done in both transverse and coronal planes. The subsequent MRI findings were then compared with the surgical observations. It was noted that among the 26 patients, twenty-one had active fistulas. The MRI findings coincided with the examination findings during anesthesia and/or surgery in 15 out of 16 cases. Both coronal and transverse planes were effective in assessing the location and direction of tracts and abscesses. The contrast-enhanced T1W FSE and fat-suppressed T2W FSE images were found to be valuable in assessing the course of tracts and the activity of lesions. Hence, MRI was found to be in accurate correlation with surgical findings, which proved beneficial for preoperative management and surgical planning.[21]

Nalan Yildrium et al (2012) carried out a study to identify the perianal fistula type and gather essential information to aim in surgical decision-making. The researchers also aimed to decide the most useful MR sequences for readers with different experience levels. The study included MR examination of 33 MRI examinations in 26 patients with suspected perianal fistula between 2007 and 2010. The MR sequences obtained in both the coronal and axial planes included, thin slice high-resolution T1-weighted (W) spin echo; T2-weighted turbo spin echo; short tau inversion recovery (STIR); and native and contrast-enhanced T1-weighted gradient echo fast low-angle shot (FLASH) images with fat suppression (FS-CE-T1W-GRE).

Three radiologists interpreted the MRI findings and compared them to the surgical results of seventeen patients. Significant agreement was found between the fistula classification and surgery when using the FS-CE-T1W-GRE sequence for Reader 1 (Cramer's V=0.701, P = 0,022) and Reader 3 (Cramer's V=0.716, P = 0,043). For Reader 2, significant agreement was achieved using the FS-CE-T1W-GRE (Cramer's V=0.703, P = 0,011) and the T2W images (Cramer's V=0.648, P = 0,027) between fistula classification and surgery.

All sequences showed substantial agreement between readers for fistula classification, internal opening location, and the presence of sinus tracts, abscess, a horseshoe component, and inflammation.

In conclusion, the combination of FS-CE-T1W-GRE images with either T2W or STIR images collected in both the coronal and axial planes was deemed sufficient for assessing the surgical extent required. [22]

Mahmoud E.Agha et al (2013) did a prospective comparative study in which the primary goal was to assess the effectiveness of preoperative imaging in perianal fistula diagnosis and to identify and address any inaccurate MRI results. The study also aimed to suggest recommendations on reducing false positive MRI results that might lead to unnecessary surgery. The study included 100 patients; 50 patients (group A) underwent surgery based on preoperative MRI, and for the other 50 patients (group B) no MRI was done and were operated directly. Results from group A revealed 24 surgically proven Grade I, 13 Grade II patients, 4 Grade III patients, 4 patients with Grade IV, and 3 Grade V patients. MRI grading indicated 26 Grades I, 13 Grade II, 4 Grade III, 4 Grade IV, and 3 Grade V. Two patients were incorrectly identified as positive. Postoperative complications included 2 recurrences, 1 case of incontinence, and 1 case with both recurrence and incontinence.

In group B, there were 22 surgically proven Grade I patients, 11 Grade II patients, 8 Grade III patients, 3 Grade IV patients, and 3 Grade V patients.

The clinical preoperative grading showed 42 grade I patients and 8 grade II patients. Three patients were false positives. Postoperative complications included 17 recurrences, 6 cases of incontinence, and 3 cases with both recurrences and incontinence. The study concluded that MRI is a valuable tool for preoperative imaging of perianal fistula. However, it highlighted the potential for false positive results that could lead to unnecessary surgeries. To address this, the study recommended standardizing IV gadolinium contrast as routine protocol or using complementary Color Doppler US examination of the fistulous track to improve the accuracy of preoperative assessments.[23]

Kulwinder Singh et al (2014) conducted a study to determine the effectiveness of Magnetic Resonance Imaging in detecting and characterizing the perianal fistulae, and to compare MRI findings with surgical outcomes. They selected fifty consecutive patients with suspected perianal fistulae for a prospective MRI evaluation, excluding patients with prior surgery or recurrent perianal fistula. The MRI findings were compared with surgical results based on "St. James's University Hospital MR Imaging Classification of Perianal Fistulae" and the study also compared T2-weighted fat-saturated and postcontrast sequences. Perianal fistulae perioperatively in 45 patients were confirmed among a total of 50 patients. The result demonstrated a sensitivity of 95.56% and 87.5% of perianal fistula and abscess respectively, and a specificity of 80% and 95.24% respectively. MRI also showed high sensitivity in identifying the secondary tract (93.75%), internal opening (95.83%), and horse-shoeing (87.50%). The study accepted the null hypothesis when comparing the results of T2-weighted fat-saturated sequences and postcontrast T1-weighted fat-saturated sequences.[24]

Dr. Muhammad Fahim Amjad and Dr. Abdul Nasir Muhammad (2015) conducted a prospective study to investigate the effectiveness of MRI in detecting and classifying perianal fistula. They conducted the study at the Radiology Department of King Khalid Civilian Hospital in Tabuk, Kingdom of Saudi Arabia over two years period from February 2013 to February 2015. During this 2-year study, 48 patients (42 males and 6 Females) out of 60 patients underwent MRI evaluation of the Perianal fistula, using a variety of MRI sequences. The fistulas were classified and the study revealed that Grade 1 was the commonest type of fistula, accounting for 37.5% of cases. Interestingly, the internal opening was most commonly found at the 6 o'clock position.

Furthermore, the study showed that post intravenous contrast-enhanced Axial and coronal oblique (CE FST1WFSE) Fat suppressed T1 weighted Fast spin echo and Axial and coronal Fat suppressed T2W FSE sequence (FST2WFSE) exhibited impressively high accuracies of 98.13% and 97.06% respectively, in diagnosing anorectal fistulae. These findings highlight the potential of MRI as the preferred imaging modality for preoperative assessment of the perianal fistula, offering valuable insights that align closely with surgical findings. By prioritizing MRI in evaluating perianal Fistula, we can significantly enhance surgical management, potentially reducing the risk of residual/ recurrence disease and associated complications such as fecal incontinence.[25]

Narvir Chauhan and Dinesh Sood (2016) conducted a prospective hospital-based study for over one year from April 2014 to April 2015 in their institute's. The study included 50 consecutive patients with perianal fistulous disease who met specific criteria and underwent MRI. The perianal fistulae were assessed and classified, considering various factors such as anatomical plane, length and associations. Surgical correlation was performed in 31 patients, while the remaining 19 patients chose alternative medicine or postponed their surgery. The study showed higher

prevalence of the disease in males. The MRI demonstrated a high sensitivity of 93.7% and a positive predictive value (PPV) of 96.7% compared to surgical findings. Notably 38% of patients preferred alternative medicine or non-surgical treatment. The study concluded that MRI is a very sensitive modality for evaluating perianal fistula and identified preference for non-surgical treatment by a significant number of patients alongside the predominance of middle-aged men being affected.[26]

Nasreen Mohey and Tamir A. Hassan (2017) performed a prospective study on 30 patients in the age range of 14 to 44years. They established a correlation between preoperative MR grading and surgical outcomes. The study showed that MR grading demonstrated high sensitivity (95.8%), specificity (83.3%), PPV (95.8%), NPV (83.3%), and weighted Kappa (0.79) with a significant P value of 0.000.

The study concluded that MRI is a valuable tool for grading fistula and its complications. Accurate pre-operative grading using MRI may reduce surgical complications.[27]

Milind Sawant et al (2017) studied the precision and predictive values of pre-operative MRI in diagnosing the severity of perianal fistulas and associated conditions, such as internal anal opening, secondary tract, abscess, and supra levator extension. The study included 44 patients who underwent MRI and were evaluated using the grading system and were also assessed for severity and presence of the associated conditions. The pre-operative MRI grading was compared with the surgical findings in 26 patients who underwent surgery. The study found that out of 41 out of 44 clinically suspected perianal fistulas (93%) were diagnosed as such by MRI. The most common type observed was grade I, found in 12 patients (27.3%) and followed by grade IV fistula, seen in 10 patients (22.7%). All 26 patients evaluated through surgery were graded identically

by pre-operative MRI for the sensitivity of the perianal fistula. MRI demonstrated 100% sensitivity in accurately delineating the fistulous tract, identifying secondary tracts, and detecting abscess.[28]

Suraj Kumar et al (2018) conducted a prospective assessment of patients with perianal fistulae to explore the correlation between clinical examination and operative findings with the MRI results. The objective was to assess the utility of MRI as a preoperative diagnostic tool for managing fistula in ano. The study was performed at the Surgery Department and MRI unit of the Radiology Department of JLNH and RC, Bhilai. They used a high-spatial-resolution MR imaging for all the patients. The imaging findings were correlated with the intraoperative surgical findings. The results revealed that MR accurately identified fistula patients with side branching and those with abscess cavities, all of which were confirmed intraoperatively. Notable, 56 out of 60 patients showed complete correlation with MRI for the primary track, highlighting the clinical significance of this correlation. The study also demonstrated that MRI had 96% sensitivity and 100% specificity for primary tract and internal opening as well as 100% sensitivity and specificity for abscesses and multiple tracks. The concluded that MRI plays a crucial role in the effective treatment of perianal fistulae by providing more precise anatomical information, thereby increasing the likelihood of successful surgical treatment. Thus, the study underscores the importance of MRI as an essential preoperative investigation tool for fistula in ano.[29]

Duc Vo et al (2019) carried out a study that aimed to investigate the potential of MRI in the diagnosis and characterization of fistula-in-ano, agreement between MRI and preoperative findings. Over a period spanning from January 2016 to January 2018, 367 patients with fistula-in-ano underwent diagnostic MRI and subsequent surgical procedures at the University Medical Center. The study found subsequent agreement

between MRI and surgery. Specifically, T2-weighted turbo spin-echo (T2W TSE) and postcontrast fat-saturated T1-weighted turbo spin-echo (FS T1W TSE) sequences proved to be highly accurate in depicting the features of fistula-in-ano. The studies result suggest that MRI can serve as a reliable tool for the preoperative evaluation of fistula-in-ano, with contrast administration recommended where appropriate to aid in distinguishing abscesses from active inflammation.[30]

Saurabh S Kakani et al (2021) carried out a study to describe the MRI role in diagnosing and grading of perianal fistula. The retrospective study included 60 patients with fistula who underwent 1.5 T MRI. These patients were carefully selected based on specific inclusion and exclusion criteria. The study involved injecting normal saline from the external opening into the tract and obtaining three types of images (T1W, T2W, and STIR). The findings revealed that the most common fistula was transsphincteric, occurring in 31 cases (51.6%), followed by intersphincteric fistula in 22 cases (36.6%). Extrasphincteric and suprasphincteric fistulas were less common occurring in 4 (6.66%) and 3 (5%) cases, respectively. The MR accurately diagnosed the internal opening, abscess cavity, or secondary tract in 23 patients. The study included 46 males and 14 female patients, resulting in a male-to-female ratio of 1:1.3.[31]

Adityan R et al (2021) described the role of imaging in perianal fistula. This study described that the presence of the fistula can lead to recurrent issues even after treatment, often due to missed tracts or tissues. Therefore, a comprehensive pre-surgical mapping is essential to achieve optimal surgical outcomes and select the most appropriate surgical techniques for treating different types of fistulas. Various modalities have been utilized for fistula assessment. Among these modalities, MR fistulography is generally preferred for interpreting fistulas due to its higher resolution of soft tissues, avoidance of ionizing radiation, thereby reducing

the risk of radiation-induced cancer, and its non-invasive nature, which minimizes patient discomfort and complications.

This literature review emphasizes the significance of imaging in perianal fistulas interpretation, especially highlighting MR fistulography as an accurate pre-operative, post-operative, and follow-up imaging modality for perianal fistulas. It also discusses the latest advancements in perianal fistulas imaging. Additionally, the literature covers various constructive surgical techniques for treating perianal fistulas.[32]

Santillan et al (2021) discussed about the important information to convey regarding the complexities of fistula, to guide its treatment and further evaluate the response to treatment. The postoperative complications of fistulas are also discussed as MRI can provide information regarding the success or failure of post-surgical management. This study described how the radiologist's familiarity with the normal regional anatomy is vital in accurately describing perianal fistula and any associated complications. This description can be utilized to classify the fistulas based on several available classification systems. This study also proposed a reporting template that includes the necessary information to convey fistula complexity, guide treatment, and evaluate response to treatment. [33]

Radhwa El Sharbatly et al (2022) conducted a study to explore the use of MRI special diffusion weighted imaging/diffusion tensor imaging technique in evaluating perianal fistula activity. The researchers performed a prospective analysis, confirming fistula activity through intraoperative findings. They categorized the cases into two groups based on surgical findings and used DWI and DTI on MRI to assess them. Additionally, they quantitatively evaluated DTI FA and ADC values. The study revealed that cases with positive inflammatory activity showed relatively lower FA

values and relatively higher ADC values compared to cases with negative inflammatory activity, which exhibited higher FA and lower ADC. [34]

M W Ahmed et al (2022) conducted a study to evaluate the use of MRI in surgical correlation for 50 patients. Of the 50 patients, 45 were males and 5were females. It was found that 5 out of 50 patients had pilonidal sinus surgery. The study revealed that MRI had a sensitivity of 97.7% and a specificity of 83.3% in identifying the primary tract, while the abscess showed a sensitivity of 88.8 % and a specificity of 95.1%. Additionally, the MRI accurately detected internal openings in 95.4 % of cases, horseshoe formation in 90.9% and secondary ramification in 92.8 %. The findings suggest that MRI demonstrates promising performance in pre-operatively evaluating fistulas to prevent recurrence. [35]

Wei Wei Zhao et al (2023) did a study by using magnetic resonance imaging to comprehensively evaluate perianal fistula and their complications. The study included 115 patients who underwent imaging evaluation, revealing a total of 169 fistulas. These fistulas were meticulously classified based on Park's and St. James classifications, shedding light on the distribution and characteristics of different types of fistulas. Based on Park's classification, 150 (88.7%) primary fistula were found which were further classified into intersphincteric(82, 54.7%), transsphincteric (58,38.6%), suprasphincteric (8,5.3%), extrasphincteric (1,0.7%) and diffuse intersphincteric with transsphincteric (1,0.7%). Based on St. James classification, 149 fistulas were classified into grade I (53, 34.9 %), grade II (30, 20.1%), grade III (20, 13.4%), grade IV (38, 25.5%) and grade V (9, 6.1%). There were 92 simple fistulas (54.4%), 77 complex (45.6%), 72 high fistulas (42.6%) and 97 (57.4%) low fistulas. 32 Secondary tracts were detected in 23 patients (20.0%) and 87 abscess in 60 patients (52.2%). Levator ani muscle involvement and soft tissue edema were detected in 12 (10.4%) and 24 (20.9%) patients respectively.

The study also identified various patterns and complexities of the fistulas, providing valuable insights into their nature and implications for potential treatment strategies. Additionally, specific anatomical involvements further enriched the findings of the study, contributing to a more comprehensive understanding and their clinical implications. [36]

MATERIAL AND METHODS

SOURCE OF DATA

This prospective study was conducted from 15 September 2022 to 31 March 2024 on patients referred for MRI perineum to the Department of Radio-diagnosis, Dayanand Medical College & Hospital, Ludhiana.

METHOD OF COLLECTION OF DATA

All patients detected with a perianal fistula on Magnetic Resonance Imaging (MRI) were included in the study. Consent was obtained from each patient and a relevant detailed history was elicited. Findings of general physical and systemic examination were recorded. Before conducting the study, the procedure was explained to the patient in his/her vernacular language to allay the anxiety and fear. A contrast study was done in MR wherever indicated.

Inclusion Criteria

1. Patients diagnosed/ suspicious of perianal fistula.
2. Previously operated cases requiring revision surgery.

Exclusion Criterion

1. Patients with underlying inflammatory conditions/ autoimmune disease
2. Patients who refuse to participate in the study
3. Uncooperative patients
4. Patients with metallic implants and other contraindications to MRI

MR imaging technique

MR imaging was performed on a 3 Tesla unit (MagnetomSkyra, Siemens, Germany.) using sequencesT1 TSE Axial, T2 TSE Axial, T2 TSE Saggital, T2 TSE Coronal, DWI, T1 Post Contrast FS Axial, T1 post-contrast FS Coronal, T1 post-contrast FS Saggital and T2 FS axial.

Table 1: MR imaging technique

Sequence	T1 TSE Axial	T2 TSE Axial	T2 TSE Saggital	T2 TSE Coronal	DWI	T1 Post Contrast FS Axial	T1 post contrast FS Coronal	T1 post contrast FSSaggital	T2 FS axial
Acquisition Time	2.30min	2.40min	3.10 min	2.50 min	3.20 min	2.30 min	3.000min	2.40 min	3.00min
Orientation	Transverse	Transverse	Saggital	Coronal	Transverse	Transverse	coronal	Saggital	Transverse
Resolution Matrix	320	384	320	384	114	320	320	320	384
No. of slices	30	30	25	30	30	30	30	30	30
FoV Read(mm)	220	220	230	230	220	220	220	220	220
FoV phase (%)	100	100	100	100	100	100	100	100	100
Slice thickness(mm)	3mm	3mm	3mm	3mm	3mm	3mm	3mm	3mm	3mm
Slice Gap(mm)	1mm	1mm	1mm	1mm	1mm	1mm	1mm	1mm	1mm
Repitition Time(msec)	680msec	3100msec	2800msec	2800msec	4000msec	680msec	630msec	630msec	3120msec
TE(msec)	18msec	89msec	86msec	87msec	64msec	18msec	20msec	20msec/1000msec	89msec
Flip Angle	150	150	150	150	-	150	150	150	150
Flow Compression	Raed	Slice	No	No	-	Read	No	Read	Slice

DURATION OF STUDY- One and half year (15 September 2022 to 31 March 2024)

STATISTICAL ANALYSIS

Data was described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. For comparing categorical data, Chi square ($\chi 2$) test was performed and fisher exact test was used when the expected frequency is less than 5. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value were calculated. A probability value (p value) less than 0.05 is considered statistically significant. All statistical calculations were done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

OUTCOME: Using various MRI sequences the data was obtained to analyze the findings and improve the outcome.

OBSERVATION AND RESULTS

1. DEMOGRAPHIC DATA

50 patients were studied from September 2021 to March 2023. The age range of the patients was 20 to 71 years, including 40 males and 10 females (Table 3, Figure 2)**.** Maximum patients (n=17, 34%) were between 41-50 years of age, followed by 13 cases between 31-40 years of age and 8 cases with age <30 years (Table 2, Figure 1).

Table 2: Showing age distribution of patients

AGE	No. of cases	Percentage
< 30	8	16%
31-40	13	26%
41-50	17	34%
51-60	5	10%
> 60	7	14%
TOTAL	50	100%

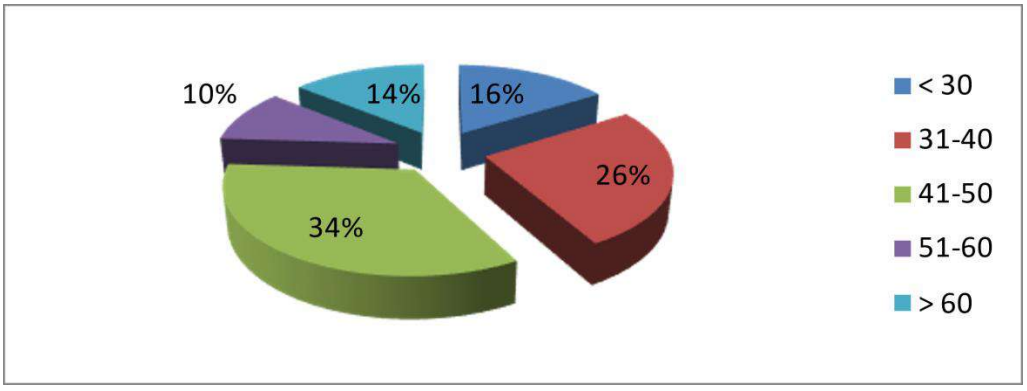

Figure 1: Showing age group distribution (years) with the number of cases

Table 3: Showing gender distribution of patients

GENDER	No. of cases	Percentage %
MALE	40	80%
FEMALES	10	20%
TOTAL	50	100%

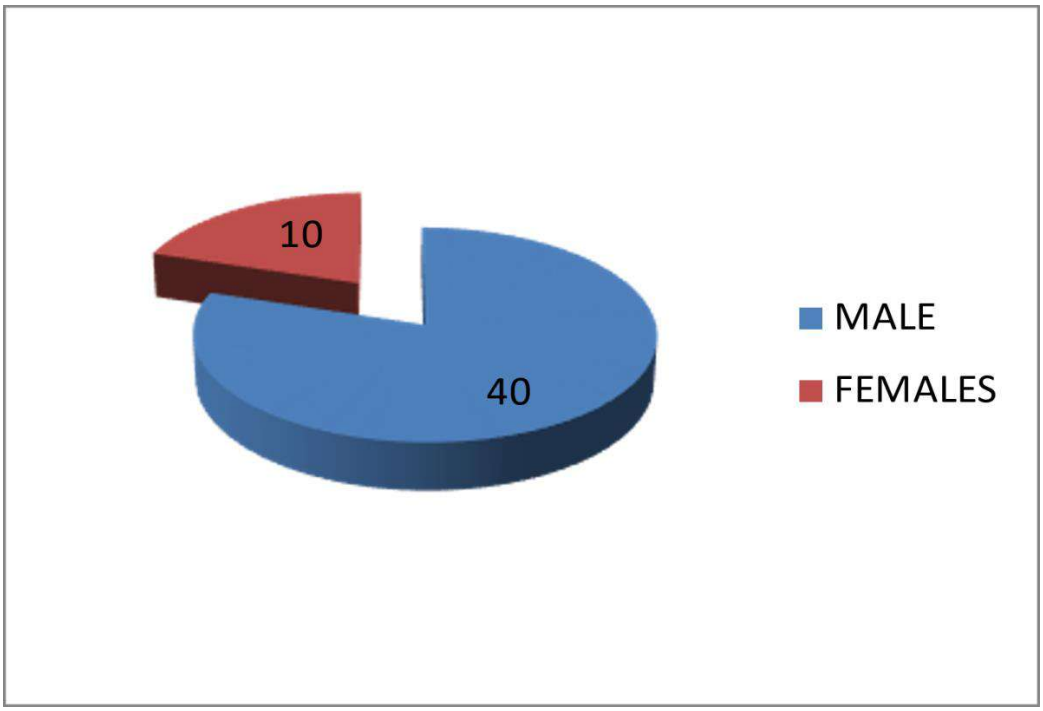

Figure 2: Showing pie chart distribution of males and females

2. CLINICAL SYMPTOMS AND EXAMINATION FINDINGS

2.1 CLINICAL SYMPTOMS

Five symptoms were studied for the patients (pain, swelling, itching, discharge, and fever). Out of 50 patients, 48 (96%) patients presented with pain, 38 (76%) patients presented with discharge, 22 (44%) patients presented with swelling,4 (8%) patients had itching and only 3(6%) patients presented with fever (Table 4 and Figure 3).

Table 4: Showing symptom distribution of patients

SYMPTOMS	No. of cases	Percentage
PAIN	48	96%
DISCHARGE	38	76%
SWELLING	22	44%
ITCHING	4	8%
FEVER	3	6%
OTHER	3	6%

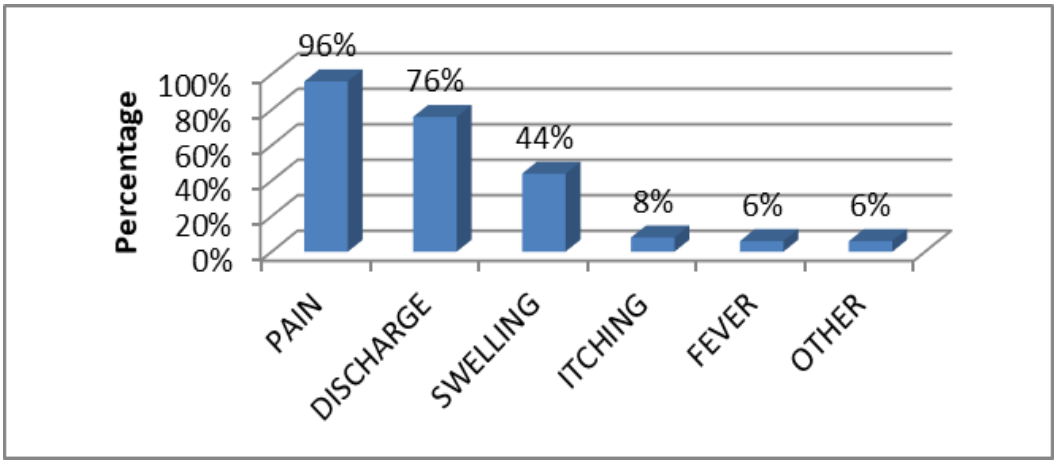

Figure 3: Showing symptom distribution

2.2 CLINICAL EXAMINATION FINDINGS

All 50 patients were examined for swelling, discharge, tenderness and external openings. Out of 50 patients, 48 (96%) had tenderness on examination and 46(92%) were found to have external openings. Discharge was present in 37 (74%) patients and 32 (64%) had swelling on clinical examination (Table 5 and Figure 4).

Table 5: Showing clinical examination findings with the number of cases

CLINICAL EXAMINATION	No. of cases	Percentage
TENDERNESS	48	96%
EXTERNAL OPENING	46	92%
DISCHARGE	37	74%
SWELLING	32	64%

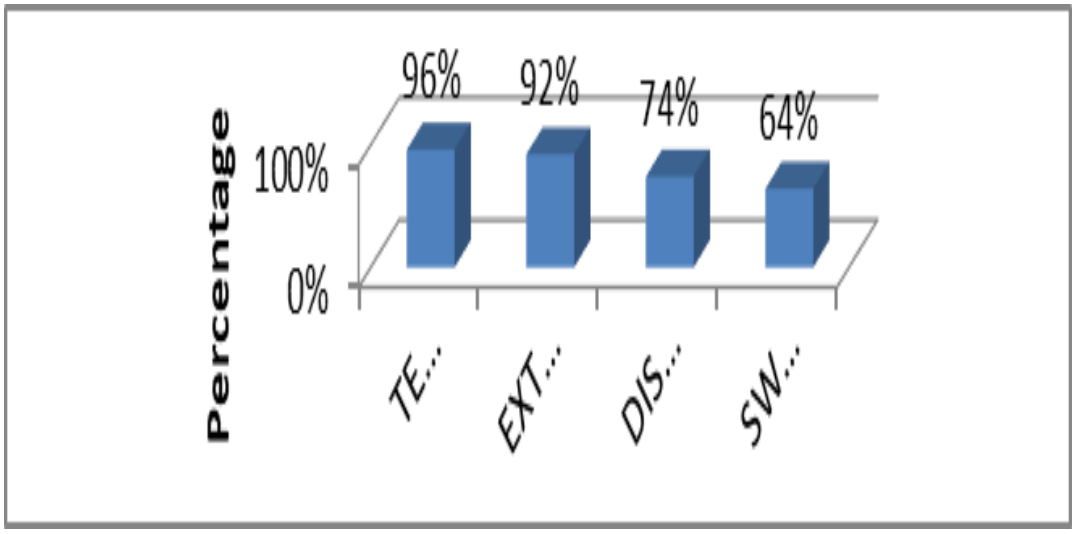

Figure 4: Showing examination findings

3. IMAGING FEATURES OF FISTULAS:

3.1. GRADING OF FISTULA

MR was conducted for these 50 patients, and the fistulas were graded using St. James's University Classification. It revealed 21 (42%) patients with grade I fistula, 10 (20%) with grade II, 6 (12%) with grade III, 9 (18%) with grade IV and 4 (8%) with grade V fistula. The results are given in the table form below (Table 6 and Figure 5). Amongst these patients, only 6 patients underwent a contrast study without any reaction to contrast media.

Table 6: Distribution of fistula grading in all 50 patients

GRADING OF FISTULA	No. of cases	Percentage
I	21	42%
II	10	20%
III	6	12%
IV	9	18%
V	4	8%

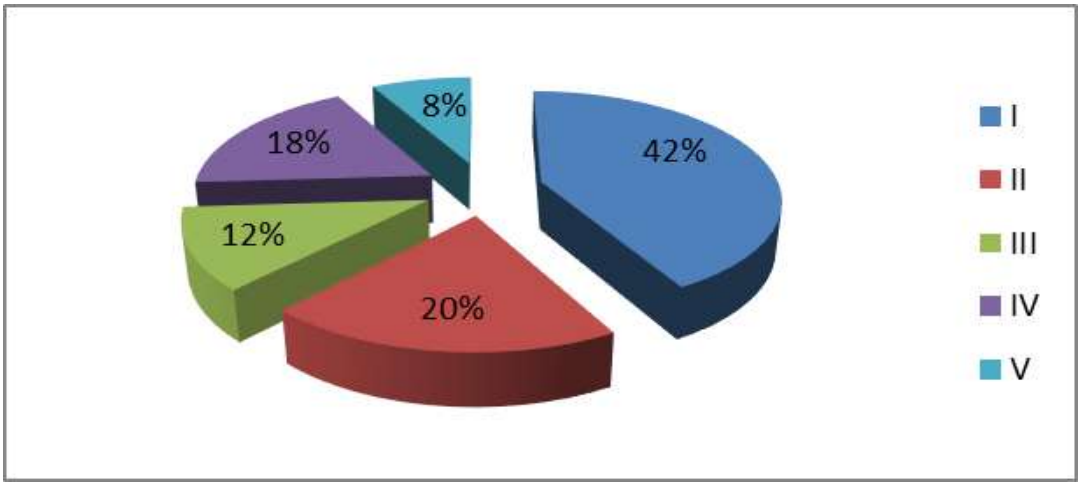

Figure 5: Shows distribution of fistula subtypes and number of cases

3.2. LOCATION OF INTERNAL OPENING

In our study, out of 50 patients, on imaging the location of the internal opening was evaluated relative to the 'anal clock' position. Out of 50 patients, three patients had no internal opening on imaging. Among 47 cases with internal openings, most of the internal openings (20) were present at the 6 o'clock position, followed by 13 internal openings at 12 'o'clock, 5 internal openings at 1 o'clock, 4 internal openings at 7' o clock, 2 at 11' o clock, 2 at 5' o clock, and lastly, 1 internal opening was present at 10' o clock.

Table 7: Showing the location of the internal opening

SITE OF INTERNAL OPENING ACCORDING TO O'CLOCK	No. OF INTERNAL OPENINGS	PERCENTAGE
6'o clock	20	43%
12'o clock	13	28%
1'o clock	5	11%
7'o clock	4	9%
11'o clock	2	4%
5'o clock	2	4%
10'o clock	1	2%
Total	47	

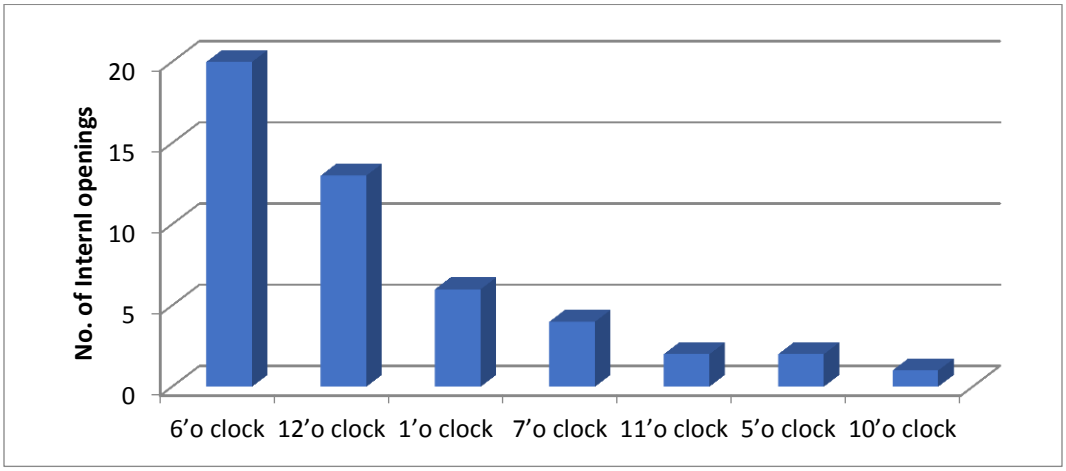

Figure 6: Showing the location of the internal opening

3.3. NUMBER OF EXTERNAL OPENINGS

On imaging, out of 50 patients, 43 (86%) cases showed 1 external opening, 3 (6%) showed 2 external openings, and the rest, 4 (8%) cases had no external opening on imaging (Table 8 and Figure 7).

Table 8: Showing distribution of the number of the external opening

No. of external openings	No. of patients	Percentage
1	43	86%
2	3	6%
No opening	4	8%

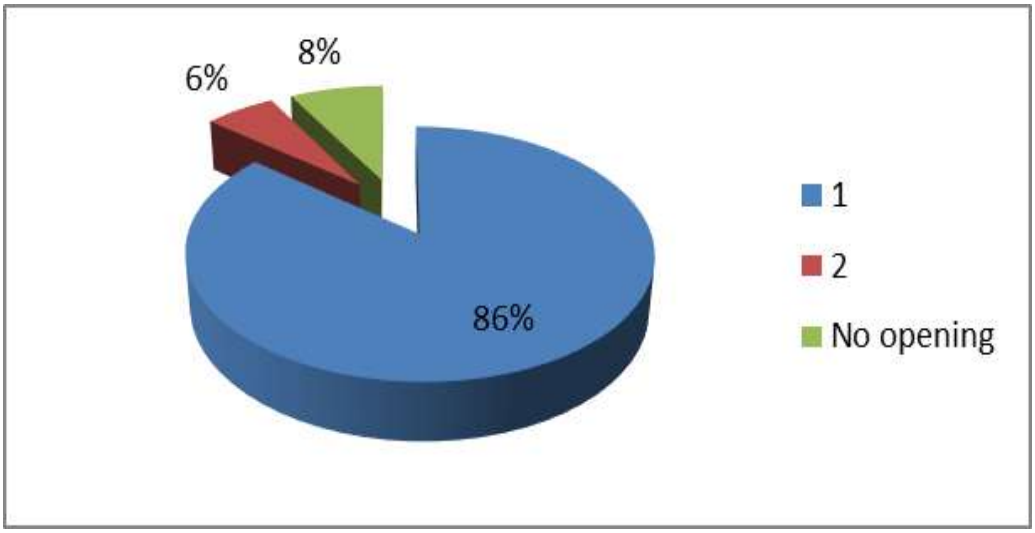

Figure 7: Showing distribution of the number of the external opening

3.4. MR SEQUENCE COMPARISON OF FISTULAS:

A correlation of preoperative MR findings on different selected sequences was made. For this evaluation, DWI, T2, T2FS, and T1 post-contrast MR sequences were used to detect internal opening, 1^0 fistulous tract, 2^0 fistulous tract, abscess, horseshoe complex, and supralevator extension on each of the above-mentioned sequences. There were 47 cases where the internal opening was present on imaging, and 50 patients had 1^0 fistulous tract. 2^0 Fistulous tract was present in 13 cases, and the abscess was found in 15 patients. Horseshoe complex and supra levator extension were in 6 and 4 patients, respectively. The contrast study was only done in 6 patients, amongst which 6 patients had internal opening and 1^0 fistulous tract each, one patient had horseshoe complex, two patient had abscess formation, and none of the patients had 2^0 fistulous tract or supra levator extension.

Table 9: MR sequence comparison of fistula findings on DWI, T2, T2FS and T1 PC

	INTERNAL OPENING	1^0FISTULOUS TRACT	2^0 FISTULOUS TRACT	ABSCESS	HORSESHOE COMPLEX	SUPRALEVATOR EXTENSION
DWI	42/47 (89.3%)	48/50 (96%)	13/13 (100.0%)	15/15 (100%)	6/6 (100%)	4/4 (100%)
T2	47/47 (100%)	50/50 (100%)	13/13 (100%)	14/15 (93.3%)	6/6 (100%)	4/4 (100%)
T2 FS	47/47 (100%)	50/50 (100%)	13/13 (100%)	15/15 (100%)	6/6 (100%)	4/4 (100%)
T1PC	6/6 (100%)	6/6 (100%)	-	2/2(100%)	1/1 (100%)	-

As shown in the table above (Table 9), DWI was able to show 42 (89.3%) cases with internal openings out of a total of 47 patients. 48 (96%) with 1^0 fistulous tracts, 13 (100%) with 2^0 fistulous tracts, 15 (100%) cases with abscess, 6 (100%) cases with horseshoe complex, and 4 (100%) with supra levator extension.

T2 demonstrated 47 (100%) cases with internal opening, 50 (100%) with 1^0 fistulous tract, 13 (100%) with 2^0 fistulous tract, 14 (93.3%) cases with abscess, 6 (100%) cases with horseshoe complex and supra levator extension in 4 (100%) cases.T2 FS identified 47 (100%) cases with internal opening, 50 (100%) with 1^0 fistulous tract, 13 (100%) with 2^0 fistulous tract, 15 (100%) cases with abscess, 6 (100%) cases with horseshoe complex and 4 (100%) supra levator extension.

Only 6 patients underwent contrast study, and on T1Post contrast sequence, an internal opening was seen in 6 (100%) cases, 6 (100%) with 1^0 fistulous tract, 2 (100%) cases with abscess, 1 (100%) case with horseshoe complex and no patient had 2^0 fistulous tract or supra levator extension amongst the contrast studies.

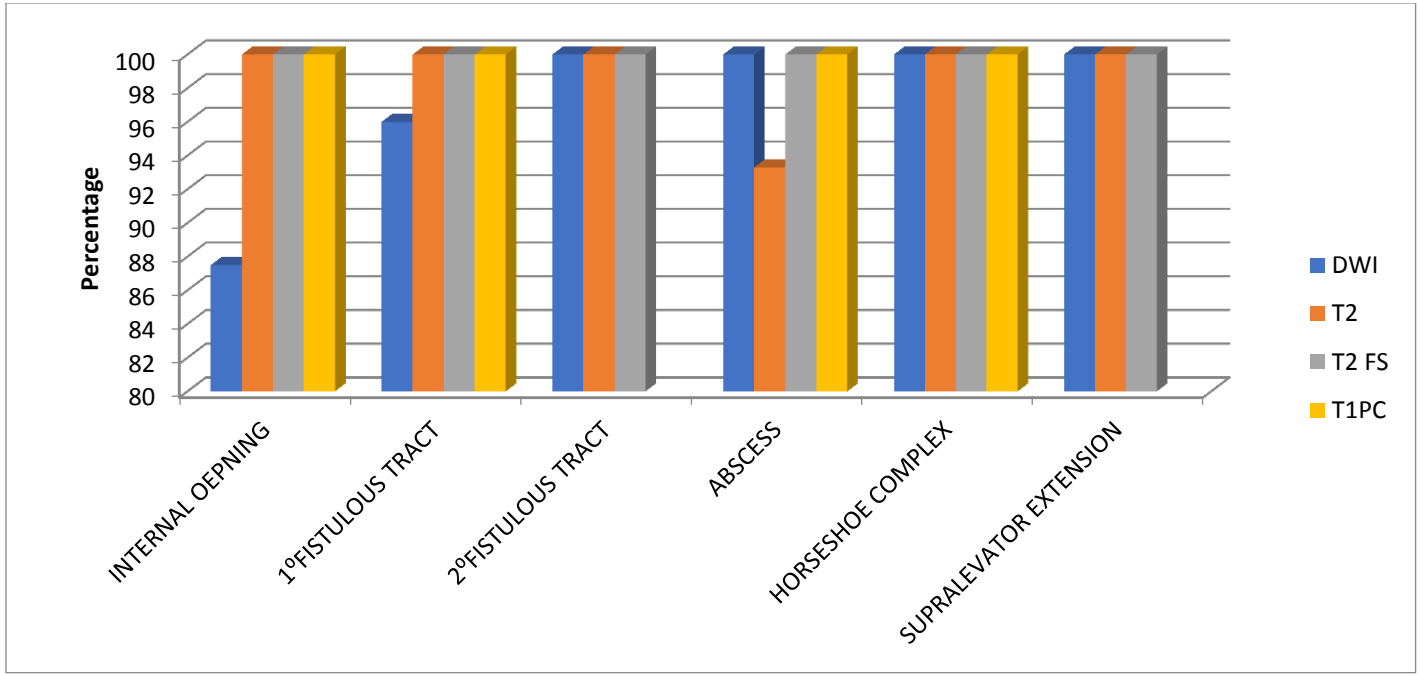

Figure 8: Showing distribution of various fistula findings on DWI, T2, T2 FS andT1

4 MR SURGICAL CORRELATIONS OF FISTULAS:

We correlated the findings of MR imaging with surgical findings in 50 patients.

4.1 Type of fistula on MRI and surgical findings:

On MR: 31 (62%) patients were classified to have intersphincteric fistula, amongst which 21 (42%) were grade I and 10 (20%) were grade II on MR, 15 (30%) were classified as Transsphincteric fistula (TS), with 6 (12%) being grade III and 9 (18%) grade IV on MR, and 4 (8%) were classified as grade V fistula as described in Table 10.

On SURGERY: 31 (62%) patients were confirmed to have intersphincteric fistula, 15 (30%) were confirmed to have Transsphincteric fistula (TS) on surgery, and 3 (6%) were confirmed as suprasphincteric fistula and lastly, 1 (2%) were confirmed to be extrasphincteric fistula (ES) as described in Table 10.

Table 10: Comparison of St. James's University MR Fistula Radiology classification with Park's Classification:

St. James's University MR Fistula Radiology classification			Park's Classification	No. of cases	Percentage
Grade I	21	42 %	**Intersphincteric fistula**	31	62%
Grade II	10	20%			
Grade III	6	12 %	**Transsphincteric fistula**	15	30%
Grade IV	9	18%			
Grade V	4	8 %	**Suprasphincteric and Extrasphincteric**	3 + 1	8%
TOTAL	50			50	

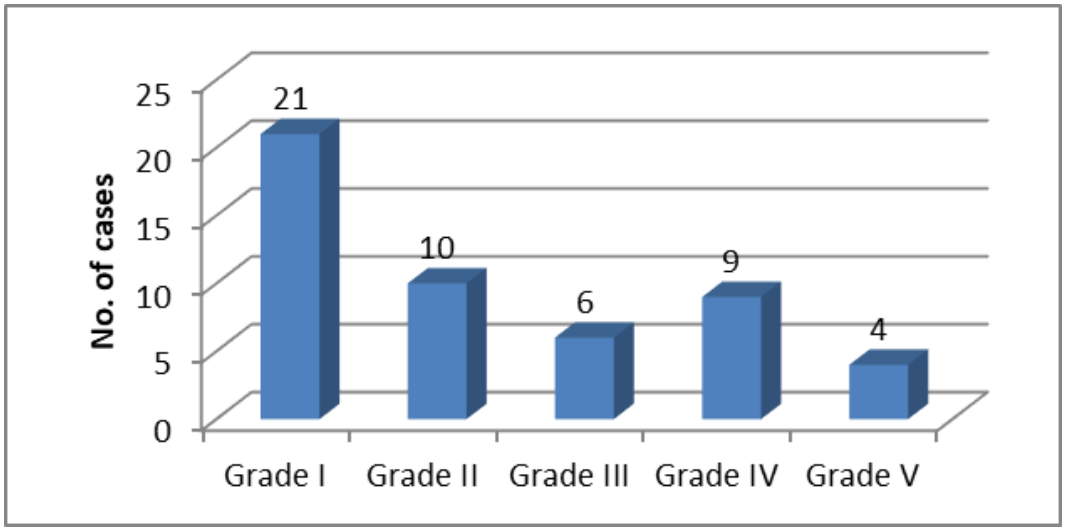

Figure 9: Showing types of fistula on MR

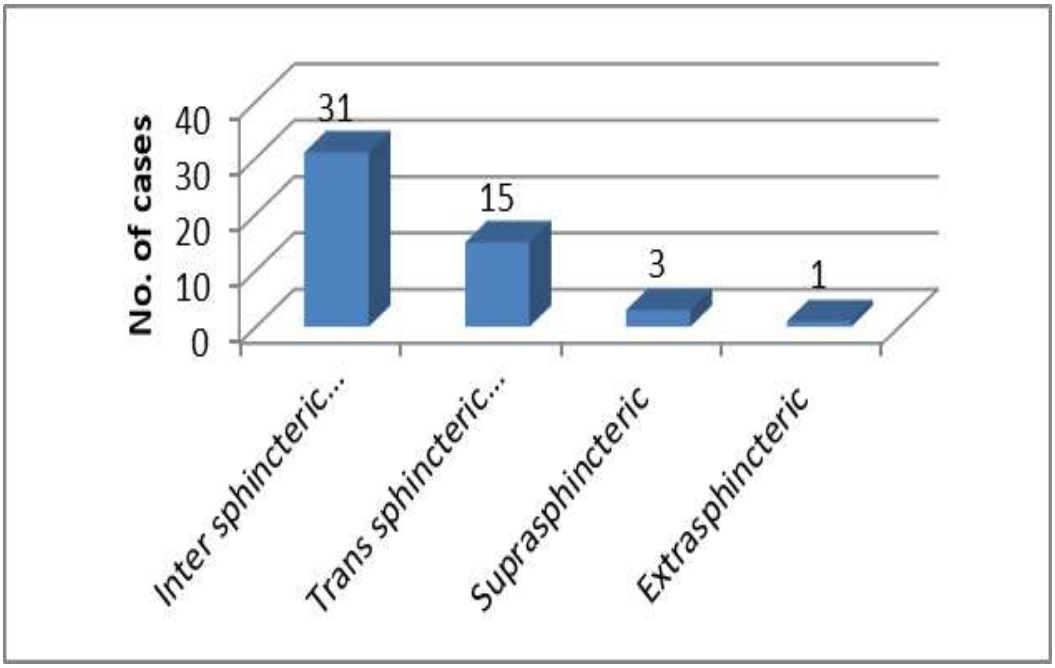

Figure 10: Showing types of fistula on surgery

4.2 Correlation of 2^0 fistulous tract on MRI with surgical findings:

On MRI, secondary tracts were identified in 13 patients, and surgery detected 11 patients with secondary tracts. Thus, two patients were identified to have 2^0 fistulous tracts on MR but not found on surgery. Hence, for correctly detecting 2^0 fistulous tracts, it had a sensitivity of 100%, specificity of 94.8 %, positive predictive value of 84.6%, and negative predictive value of 100% with an accuracy of 96%.

Table 11: Showing correlation of 2^0 fistulous tract on MRI with surgical findings:

		2^0 FISTULOUS TRACT SURGERY FINDINGS		TOTAL
		PRESENT	ABSENT	
2^0 FISTULOUS TRACT MRI FINDINGS	PRESENT	11	2	13
	ABSENT	0	37	37
TOTAL		11	39	50

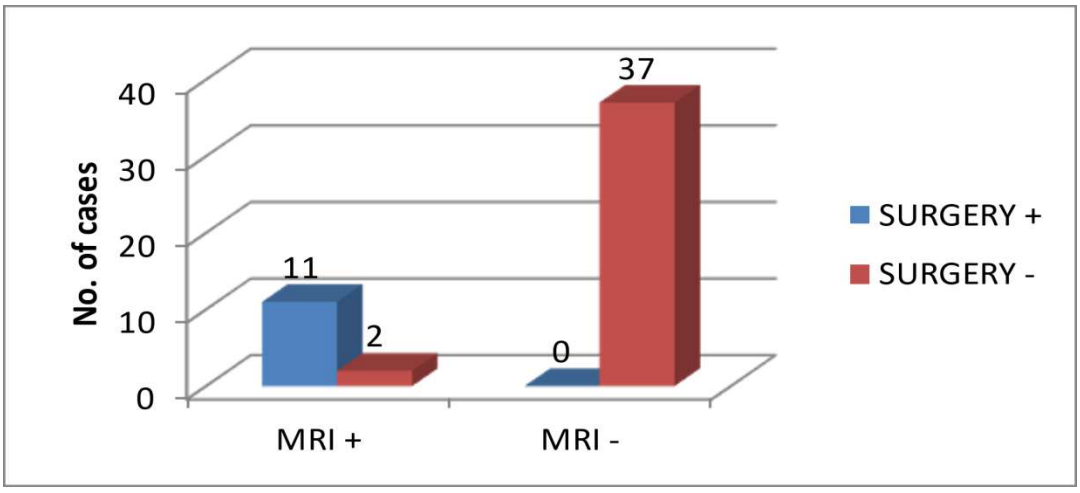

Figure 11: showing correlation of 2^0 fistulous tract on MRI with surgical findings:

4.3 Correlation of internal opening on MRI with surgical findings:

MRI identified the internal opening in 47 patients and surgery also detected 47 patients with internal openings. However, there was one patient with no internal opening during surgery but was found on MR and one other patient with an internal opening present on surgery but not seen on MRI. Two patients had no internal opening on MRI as well as surgery. This revealed a sensitivity of 97.8%, specificity of 66.6%, positive predictive value of 97.8%, and negative predictive value of 66.6% for correctly detecting internal opening with an accuracy of 96%

Table 12: Showing correlation of internal opening on MRI with surgical findings:

		INTERNAL OPENING SURGERY FINDINGS		TOTAL
		PRESENT	ABSENT	
INTERNAL OPENING MRI FINDINGS	PRESENT	46	1	47
	ABSENT	1	2	3
TOTAL		47	3	50

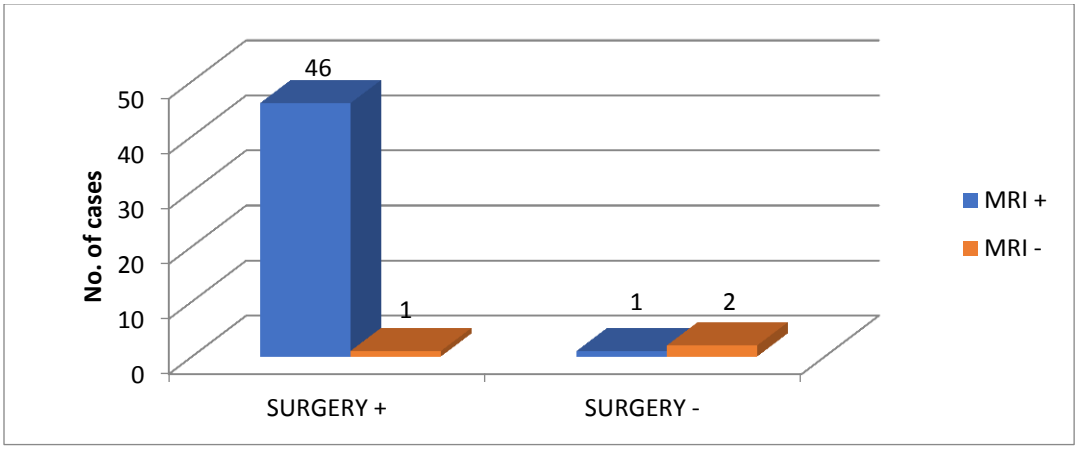

Figure 12: Showing correlation of internal opening on MRI with surgical findings

4.4 Correlation of horseshoe complex on MRI with surgical findings:

The horseshoe complex was detected on MRI in 6 patients amongst a total number of 50 patients, and surgery also identified 6 patients with the horseshoe complex. Hence, a sensitivity of 100 %, specificity of 100%, positive predictive value of 100%, and negative predictive value of 100% for correctly detecting horseshoe with an accuracy of 100%

Table 13: Showing the correlation of horseshoe complex on MRI with surgical findings:

		HORSESHOE COMPLEX SURGICAL FINDINGS		TOTAL
		PRESENT	ABSENT	
HORSESHOE COMPLEX MRI FINDINGS	PRESENT	6	0	6
	ABSENT	0	44	44
TOTAL		6	44	50

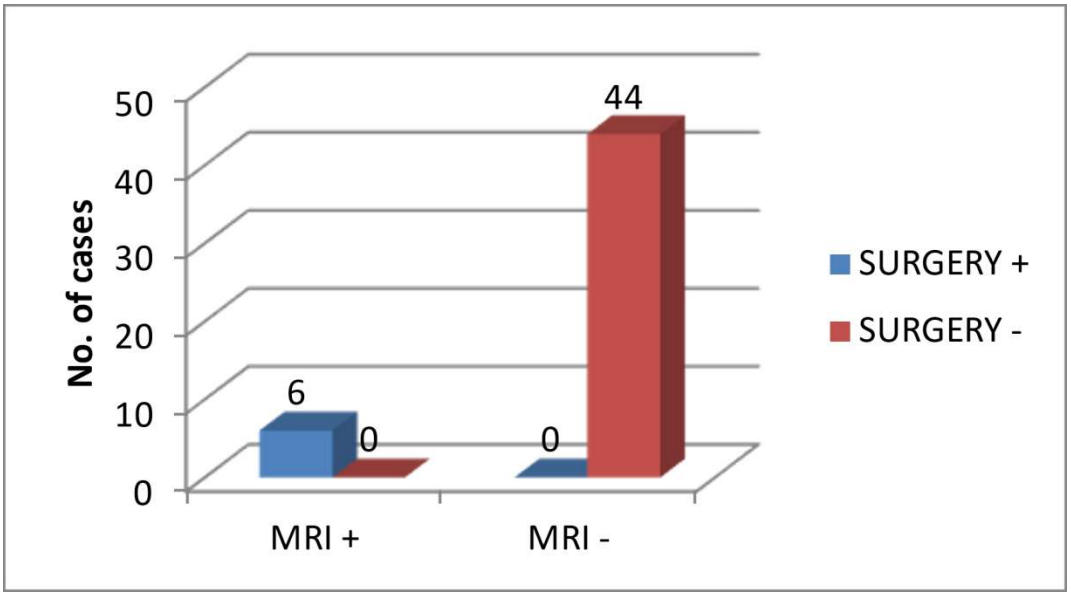

Figure 13: Showing correlation of horseshoe complex on MRI with surgical findings

4.5 Correlation of abscess on MRI with surgical findings:

On MRI 15 patients were identified to have abscess formation, however surgery detected 14 patients with abscess formation. Thus, one patient had abscess formation found on MRI but not correlated with surgery. Sensitivity of 100%, specificity of 97.2%, positive predictive value of 93.3% and negative predictive value of 100 % for correctly detecting abscess with accuracy of 98%

Table 14: Showing correlation of abscess on MRI with surgical findings:

		ABSCESS SURGICAL FINDINGS		TOTAL
		PRESENT	ABSENT	
ABSCESS MRI FINDINGS	PRESENT	14	1	15
	ABSENT	0	35	35
TOTAL		14	36	50

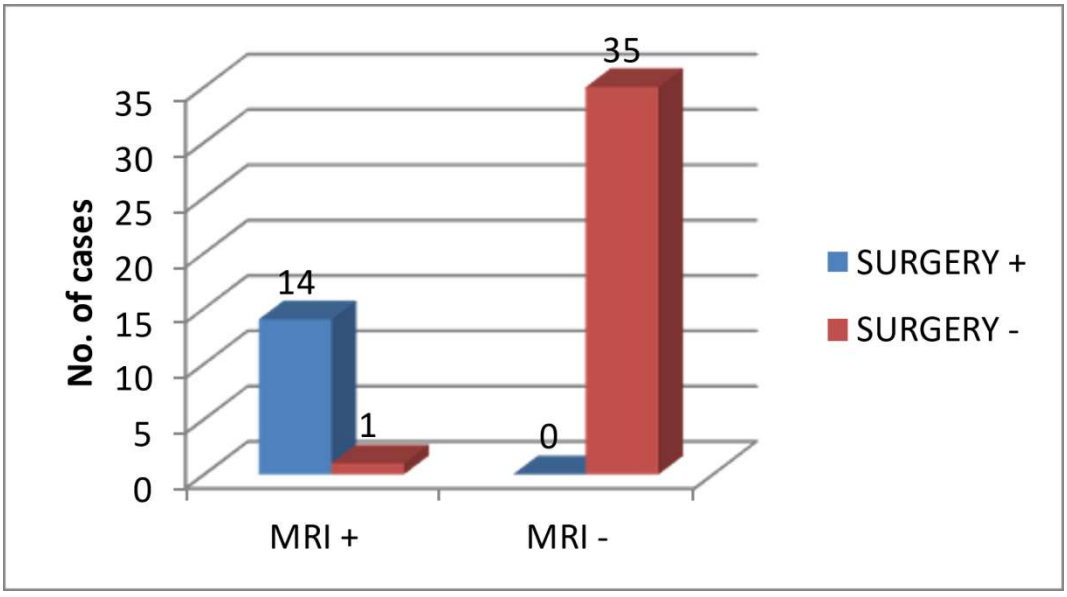

Figure 14: Showing correlation of abscess on MRI with surgical findings

4.6 Correlation of Supralevator extension on MRI with surgical findings:

On MRI, supralevator extension was diagnosed in 4 patients and all 4 patients were confirmed to have supralevator extension on surgery. Thus, it revealed sensitivity of 100%, specificity of 100%, positive predictive value of 100% and negative predictive value of 100 % for correctly detecting supralevator extension with accuracy of 100%

Table 15: Showing correlation of Supralevator extension on MRI with surgical findings

		SUPRA LEVATOR EXTENSION SURGICAL FINDINGS		TOTAL
		PRESENT	ABSENT	
SUPRA LEVATOR EXTENSION MRI FINDINGS	PRESENT	4	0	4
	ABSENT	0	46	46
TOTAL		4	46	50

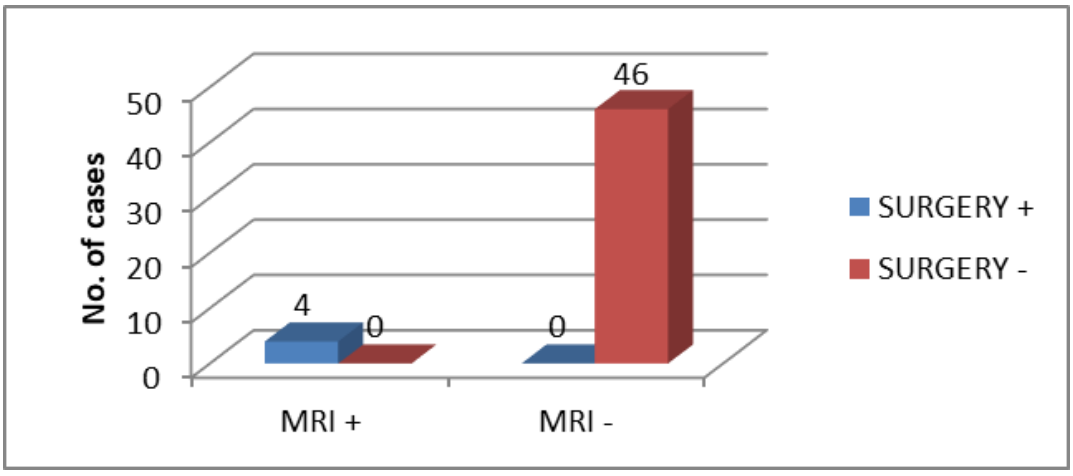

Figure 15: Showing correlation of Supralevator extension on MRI with surgical findings

4.7 Diagnostic accuracy of MRI Findings in preoperative Assessment of perianal fistula

In our study conducted among 50 patients who underwent pre-operative imaging for perianal fistula followed by surgery, findings of the secondary tract, internal opening, horseshoe complex, abscess, and supralevator extension on MR were correlated with surgery and sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were attained from the data collected.

Table 16: Showing sensitivity, specificity, positive predictive value, negative predictive value and accuracy on MR and surgical correlation:

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
Secondary tract	100%	94.8%	84.6%	100%	96%
Internal opening	97.8%	66.6%	97.8%	66.6%	96%
Horseshoe complex	100%	100%	100%	100%	100%
Abscess	100%	97.2%	93.3%	100%	98%
Supralevator extension	100%	100%	100%	100%	100%

Table 17: Showing surgical correlation of MR findings:

	True positive	False positive	True negative	False negative
Secondary tract	11	2	37	0
Internal opening	46	1	2	1
Horseshoe complex	6	0	44	0
Abscess	14	1	35	0
Supralevator extension	4	0	46	0

Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy outcomes in our study conducted among 50 patients are described in one table. For correctly detecting 2^0 fistulous tracts, it had a sensitivity of 100%, specificity of 94.8 %, positive predictive value of 84.6%, and negative predictive value of 100% with an accuracy of 96%. For internal opening, our study revealed a sensitivity of 97.8%, specificity of 66.6%, positive predictive value of 97.8%, and negative predictive value of 66.6% for correctly detecting internal opening with an accuracy of 96%.Horseshoe complex had a sensitivity of 100 %, specificity of 100%, positive predictive value of 100%, and negative predictive value of 100% for correctly detecting horseshoe with an accuracy of 100%. Abscess formation on MR and surgical correlation showed a sensitivity of 100%, specificity of 97.2%, positive predictive value of 93.3%, and negative predictive value of 100 % for correctly detecting abscess with an accuracy of 98%. Supralevator extension had a sensitivity of 100%, specificity of 100%, positive predictive value of 100% and negative predictive value of

100 % for correctly detecting supralevator extension with an accuracy of 100% (p value of 0.001).

Comparing MR with surgical findings, it was inferred that out of 50 cases, 11 were truly positive for a secondary tract, 46 for internal opening, 6 for horseshoe complex, 14 for abscess, and 4 for supralevator extension. There were 2 cases that were falsely positive for secondary tract, 1 for internal opening, 1 for abscess and no case was falsely positive for a horseshoe complex and supralevator extension. Out of 50 cases, 37 were truly negative for a secondary tract, 2cases for internal opening, 44 for horseshoe complex, 35 for abscess, and 46 for supralevator extension. False negative cases were 1 for internal opening, and no case was found to be falsely negative for a secondary tract, horseshoe complex, abscess, and supralevator extension.

DISCUSSION

Perianal fistula is a common disease that occurs from infected anal glands and causes significant discomfort to the patient because of the continuous discharge from the fistula, affecting their quality of life. The incidence ranges from 1-2 per 10,000 patients, with an approximately 2:1 male-female ratio.[2] Perianal fistulas are primarily due to the crypotoglandular hypothesis, which suggests that obstruction to the anal gland leads to fistula or abscess formation. Secondary causes include Crohn's disease, trauma, tuberculosis, pelvic infections, radiotherapy, and malignancies. [10] Since neither the symptoms nor the clinical examination is specific for diagnosis, imaging plays a crucial role in diagnosing perianal fistula and its associated findings.

Up till now, various diagnostic methods have been used to describe the fistula, which includes retrograde fistulography, anal endosonography, computer tomography (CT) fistulography, and magnetic resonance imaging (MRI). Amongst these, MRI is the pre-eminent method of detecting and delineating the fistulas as it offers high spatial resolution and multiplanar imaging. Because of its accuracy and non-invasiveness, MRI is the primary modality of choice for evaluating the perianal fistula. Very importantly, it gives information about the relation of the fistula to the sphincter complex, thus allowing the surgeon to decide about the surgical approach. [11-12]

St James University's imaging-based classification consists of five grades which are used to classify the fistula, and surgical Park's classification is used per-operatively by the surgeon to classify the fistula according to its relation to the anal anatomy. By utilizing the imaging-based classification, radiologists can look for the involvement of the sphincter, presence of an abscess, and supra levator extension to guide the surgeon for proper surgical exploration.

The illustration of the external opening on imaging holds a trifling matter of discussion for radiologists as the cutaneous opening is well evident to the

surgeon on examination. Proctoscopy also assists the surgeon in finding the internal opening. It is the course of the track between the external and internal openings that need to be described well by the radiologist to opt for the appropriate surgical approach for management and to avoid complications of sphincter damage and its recurrence. [15]

The definite treatment of the perianal fistula is surgery. However, it has a significant chance of recurrence. Failure to recognize or misidentify fistula, its associated pathologies like secondary ramification or abscess or supralevator extension can lead to its recurrence. Thus, accurate pre-operative imaging plays a pivotal role in successful surgical management.[23]

The study's purpose was to evaluate the role of MRI in assessing perianal fistula and its correlation with per-operative findings and to compare the predictability of different MRI sequences.

DEMOGRAPHIC DATA AND CLINICAL EXAMINATION

In our current study, out of 50 patients who underwent MRI, we observed that the age range of the patients was 20 to 71 years, and the incidence of the disease was highest in the age group between 41–50 years, with a mean age of 45.7 years and male to female ratio of 4:1, with males being 80% and females being 20%. It is in close approximation to the study done by **Saurabh S Kakani et al. (2021)** in which the mean age group belonged to the age group of 41-50 years, with a male-female ratio of 1:0.3 with 76.66 % males and 23.33% females. Additionally, in another study conducted by **Suraj kumar Suresh Jajoo et al.** (2017), 60 patients were studied, out of which 88% were males, and 12% were females.

When it comes to the symptoms presented by our patients, our study found that the majority of the patients (96%) presented with pain, 76 %

presented with discharge, 44% presented with swelling, 8% presented with itching, and 4% with fever. On clinical examination, tenderness was observed in 96% of patients, external opening in 92%, discharge in 74%, and swelling in 64% of patients. These findings are in concordance with the study done by **Milind Sawant et al. (2021)** on a population of 44 patients in which most of the patients presented with pain and/or discharge in the perianal region, and external opening could be visualized in 41 (93.2%) of patients.

IMAGING FINDINGS:

EXTERNAL OPENING

In our study, the majority of the patients (86%) had a single external opening, 6% had two external openings, and 8% had no external opening. **Kulvinder Singh et al. (2014)** studied 50 patients and found that 45 (90%) had a single external opening, 4 (8%) had two external openings, and only one had three external openings.

INTERNAL OPENING

The location of the internal opening was analysed according to the anal clock position. In our study conducted on 50 patients, it was found that three patients had no internal openings, thus making a total of 47 internal openings. The most common location of internal opening was at 6 o'clock, as seen in 20 patients (43%) and the next common location was 12 o'clock in 13 patients (28%). This is consistent with a study by **Ranie et al. (2013)**, which found that out of 24 patients, half of the patients (50%) had an internal opening at 6'o clock, and the second most common opening was found to be at 12'o clock in 25% of patients, 8.3% at 7'o clock and 4'o clock each, with 4.2% revealed internal opening at 5 'o clock and 11'o clock each.

According to a prospective study by **Nasreen Mohey et al. (2017)**, the most common location of the internal opening was at the 6 o'clock position, found in 16/30 patients (53.3%), followed by 4/30 patients (13.3%) with an opening at 12 o'clock position.

Another study conducted by **Milind Sawant et al. (2021),** described the most common location of the internal opening as 6 o'clock, seen in 18 (40.9%) patients; the next common location was 7 o'clock, seen in 8(18.2%) patients.

GRADING

Based on St. James's classification, among 50 patients, 42% (21/50) had grade I fistula, grade II is the second most common type found in 20% (10/50), 18% (9/50) had grade IV fistula, 12% (6/50) had grade III, and 8% (4/50) had grade V on MRI.

Wei Wei Zhao et al. (2023) conducted a study on 115 patients and observed that grade I is the most common, grade IV is the second most common, andgrade II is the third most common, followed by grade III and grade IV.

Nasreen Mohey et al. (2016) found that grade I was the most common type, followed by grade II, grade III, grade IV, and grade V. Although the prevalence varied in every study, grade I remained the most common, as also concluded in studies by **Rania et al. in 2014 and Milind Sawant et al. in 2021.**

We graded the perianal fistula according to the Park's classification on the basis of per-operative findings as described by the operating surgeon and concluded that 62% of patients had intersphincteric fistula, 30% had transphincteric fistula, 6% had supra sphincteric fistula, and 2% had extra sphincteric fistula. This study parallels the study conducted by **Wei Wei**

Zhao et al. (2023), the transphincteric fistula was 38.6%, intersphincteric was 54.7%, suprasphincteric was 6%, and extrasphincteric was 0.75%.

MR SEQUENCE COMPARISON OF FISTULAS:

In our study, we correlated the predictability of different MR sequences to detect the perianal fistula and for this DWI, T2, T2FS, and T1 post-contrast MR sequences were evaluated and all the sequences were compared to detect internal opening, 1^0 fistulous tract, 2^0 fistulous tract, abscess, horseshoe complex, and supra levator extension. Out of 50 patients, there were 47 cases where the internal opening was present on imaging; 50 patients had 1^0 fistulous tract, 13 cases had 2^0Fistulous tract, and the abscess was seen in 15 patients. Horseshoe complex and supra levator extension was in 6 and 4 patients, respectively. The contrast study was only done in 6 patients, amongst which 6 patients had internal opening and 1^0 fistulous tract each, one patient had horseshoe complex. Abscess formation was seen in 2 patients, and none of the patients had 2^0 fistulous tract or supra levator extension.

After comparing different sequences, we found that DWI was able to detect internal openings in 89.3% (42/47) of cases and 1^0 fistulous tracts in 96% (48/50). 2^0 fistulous tracts (13/13), abscess (6/6), horseshoe complex (6/6) and supra levator extension (4/4) in100% of cases.

T2 wt. images demonstrated internal opening (47/47), 1^0 fistulous tract (50/50) and 2^0 fistulous tract (13/13) in100% cases. Abscess was found in 93.3% (14/15) cases. Horseshoe complex (6/6) and supra levator extension (4/4) in 100% of cases.

T2 FS identified the internal opening (47/47), 1^0 fistulous tract (50/50), 2^0 fistulous tract (13/13), abscess (15/15) cases, horseshoe complex (6/6) and supra levator extension (4/4) in 100% of cases.

Only 6 patients underwent contrast study, and on T1Post contrast sequence, an internal opening (6/6), 1^0 fistulous tract (6/6), abscess (2/2), horseshoe complex (1/1) was seen in 100% of cases and no patient had 2^0 fistulous tract or supra levator extension amongst the contrast studies.

On comparing these sequences, we infer that T2 fat sat wt. images is the best sequence to diagnose 1^0 fistulous tract, 2^0 fistulous tract, and internal opening. While DWI is best in diagnosing abscess, horseshoe complex, and supra levator extension, which is also comparable with T2 fat sat wt. images. The accuracy of T1 post-contrast images was comparable with T2 Fat sat images, which also showed 100% results in detecting 1^0 fistulous tract, internal opening, abscess, and horseshoe complex. However, there are certain limitations in our study in comparing the T2 Fat sat and T1 post-contrast study because the sample size of T1 post-contrast studies was too small (only 6 cases). So, based on this observation, we infer that contrast study can be omitted for the cases which are previously untreated as it does not give any additional conformation and moreover, T2 FS sequence is also equally efficient in detecting perianal fistula and associated findings.

SURGICAL CORRELATION OF INTERNAL OPENING

Out of 50 patients studied, there were 46 patients who showed MR and surgical agreement with respect to an internal opening. Thus, there were four patients who showed mismatch. Among these, one case was found to have internal opening on MR sequences but was not detected on surgery. This could be due to the reason that sometimes it becomes difficult for the surgeon to accurately localise the internal opening because in some cases internal opening is quite narrow, small and intermittently closed.

One patient had internal openings found on per-operative findings but was not seen on MRI. This must be due to the fact that fistulous tract was

fine and could not be detected by standard MR protocol**.** There were two patients in whom internal opening was not found on MR as well as surgery. Demonstration of the internal opening is of utmost importance as it will decide the extent of sphincter division during fistulotomy.

Hence the sensitivity, specificity, negative predictive value, and positive predictive value of MRI in detecting the internal opening were 97.8%, 66.6%, 66.6% and 97.8 % respectively in our study.

According to a study conducted by **MilindSawant et al. (2021)**, the sensitivity, specificity, positive predictive value and negative predictive value in detecting internal opening on MRI were 100%, 50%, 87% and 100% respectively.

In another study, **Kulvinder Singh et al. (2014)** demonstrated sensitivity of 95.8%, specificity of 80% and positive predictive value of 97.8%.

Beets-Tan et al. (2001) conducted a study in which they reported a sensitivity of internal opening of 96%, a specificity of 90% and a positive predictive value of 90%.

Pankaj G. et al. (2017), studied 229 patients and attained sensitivity of internal opening on MR to be 97.7% with specificity of 98.6%.

SURGICAL CORRELATION OF SECONDARY FISTULOUS TRACT

In our study, 13 of 50 patients had secondary tracts on MR. However, only 11 patients were confirmed to have secondary tracts on surgery. Thus, two patients who had a secondary tract on MR were not found on surgery. This misinterpretation could be because of the inflammation tissue, which was interpreted as a secondary tract on MR images.

Hence, MRI's sensitivity and specificity in detecting secondary tracts are 100% and 94.8%, with 84.6% positive predictive value, 100% negative predictive value, and 96% accuracy.

In a study done by **Milind Sawant et al. (2021)**, out of 26 patients, 14 patients (34.15%) had secondary fistulous tract with 100% sensitivity, 89.74% specificity, 77.7% positive predictive value, and 100% negative predictive value.

SURGICAL CORRELATION OF HORSESHOE COMPLEX

A Horseshoe complex is a type of ramification/secondary tract that has an extension on either side of the midline, along the horizontal plane.

In our study, horseshoe complex was found in 6 cases out of 50, and there was complete agreement between MR and surgical findings. Hence the sensitivity of 100%, specificity of 100 %, positive predictive value of 100%, and negative predictive value of 100% for correctly detecting horseshoe complex and as a result we achieved accuracy of 100%.

This was similar to the previous study conducted by **Beets-Tan et al. (2001),** which also reported that the sensitivity and specificity for correctly diagnosing horseshoe fistula were 100 % and 100%, respectively.

SURGICAL CORRELATION OF ABSCESS

Out of 50 patients studied, 15 were found to have abscesses on MR, whereas 14 cases were confirmed at the surgery to have abscesses. Hence, there was one case that showed disagreement with MR as it was not found to have an abscess on surgery. It must be attributed to the fact that this case was operated after 5-6 days of imaging, and the abscess might have drained on its own in the course of time. Thus, it was found that MR had a sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 100%, 97.2%, 93.3%, 100%, and 98% respectively.

These findings align with the previous study conducted by **Milind Sawant et al. (2021)**, where out of 26 patients, 12 were detected to have abscess formation on MR, and 11 were confirmed to have abscesses during surgery. Hence, it was concluded that it has 100% sensitivity, 100 % specificity, 100% positive predictive value, and an accuracy of 92%.

Another study carried out by **Kulvinder S. et al.** among 50 patients found a sensitivity of 87.5%, specificity of 95.2%, positive predictive value of 77.7%, and negative predictive value of 97.5% in diagnosing the abscesses.

SURGICAL CORRELATION OF SUPRA LEVATOR EXTENSION

In our study among the 50 patients, we identified 4 cases with supra levator extension on MR and on comparison between surgical and MR findings, no statistical difference was detected in correctly diagnosing supra levator extension. Our results showed a sensitivity of 100%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 100% for correctly detecting supra levator extension with an accuracy of 100% to detect supra levator extension. It was seen that T2 fat sat coronal images are better at detecting supra levator extension.

These findings are in concordance with the previous study conducted by **Milind Sawant et al. (2021),** MR showed a sensitivity of 100% with respect to supra levator extension.

Similarly, **Beets-Tan et al. (2001)** study involving56 patients who underwent imaging for anal fistula reported similar results in identifying supra levator extension.

LIMITATION

A small number of patients were included in the contrast study. Henceforth, a larger sample size would be necessary to further establish the role of contrast in the characterization of fistula.

Our study included only primary cases and thus is not applicable to recurrent/ operative cases, where the presence of distorted anatomy and scars may pose the usual challenges.

SUMMARY AND CONCLUSION

SUMMARY

- Our study included 50 patients with clinical suspicion of perianal fistula who underwent MRI followed by surgery.
- The most common age group affected was between 41–50 year and the most common type of fistula diagnosed was grade I.
- On MR sequence comparison of fistula, DWI was able to detect internal opening in 89.3% of cases, 1º fistulous tract in 96% whereas 2º fistulous tract, abscess, horseshoe complex and supra levtor extension in 100%. T2 wt. Images was able to detect abscess in 93.3% cases and rest all in 100%. T2 FS demonstrated internal opening, 1º fistulous tract, 2º fistulous tract, abscess, horseshoe complex and supra levator extension in 100% cases. T1 PC demonstrated internal opening, 1º fistulous tract, abscess and horseshoe complex in 100% cases.
- The sensitivity, specificity and diagnostic accuracy of MRI in detecting 2º fistulous tract was 100%, 94.8% and 96%.
- The sensitivity, specificity and diagnostic accuracy of MRI in detecting internal opening was 97.8%, 66.6 and 96%.
- The sensitivity, specificity and diagnostic accuracy of MRI in detecting abscess was 100%, 97.2% and 98%.
- The sensitivity, specificity and diagnostic accuracy of MRI in detecting horseshoe complex and supra levator extension was 100%, 100% and 100%.

CONCLUSION

MRI is the ideal imaging modality due to its high sensitivity and specificity. It offers comprehensive anatomical details for delineating the perianal fistula and its associated findings, making it a valuable tool for identifying and classifying perianal fistula. It provides an accurate roadmap to the surgeon and may reduce the risk of complications and recurrence. Preoperative MRI may help to avoid unnecessary wide exploratory dissection through the sphincter.

Both the coronal and axial planes play a significant role in evaluating fistulas. The coronal plane provides excellent delineation of the relationship of the fistula to the sphincter complex as well as its extension above the levator ani muscle, while the axial sections offer comprehensive information for evaluation of external as well as internal opening of the fistula and also regarding the degree of intersphincteric involvement. Hence, the 1º fistulous tract, 2º fistulous tract, and the internal opening can be easily demonstrated on axial and coronal T2/ T2 fat sat images. Delineation of abscess, horseshoe complex, and supralevator extension is best visualized with T2 fat sat, DWI, and T1 post-contrast images.

However, the results of T2 fat sat and T1 post contrast images were found to be comparable in our study, so we infer that contrast studies can be omitted in uncomplicated and untreated cases as they do not provide additional information.

These results suggest that MRI should be considered a key imaging modality in the diagnostic workup of patients with perianal fistula. Further research should continue to explore the potential improvements in imaging techniques to improve the patient outcome.

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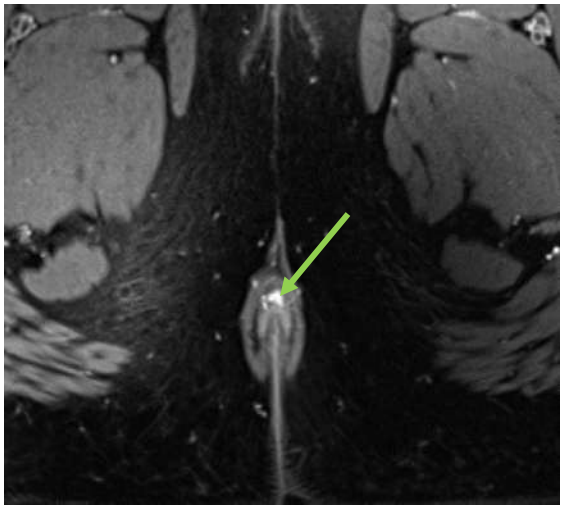
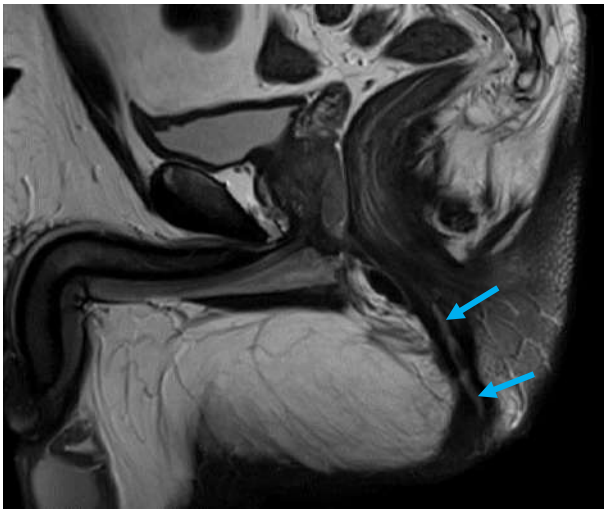


A **B**



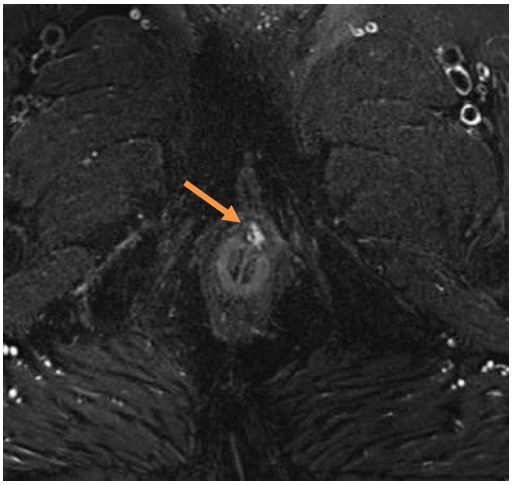
C

Picture 1:- A 25 year old male with a history of swelling and pus discharge from perianal region underwent MRI examination.

(A) Axial T2 fat sat image, showing T2 hyperintense fistulous tract in anterior intersphincteric space with internal opening at 12'o clock position (green arrow).

(B) Cor T2 wt. image reveals the tract extending anteroinferiorly to reach the right side of the natal cleft (yellow arrow)

(C) Sag T2 wt. image shows the craniocaudal extension of the tract (blue arrow). There is no ramification or abscess formation or supralevator extension seen- suggestive of low anterior simple intersphincteric perianal fistula



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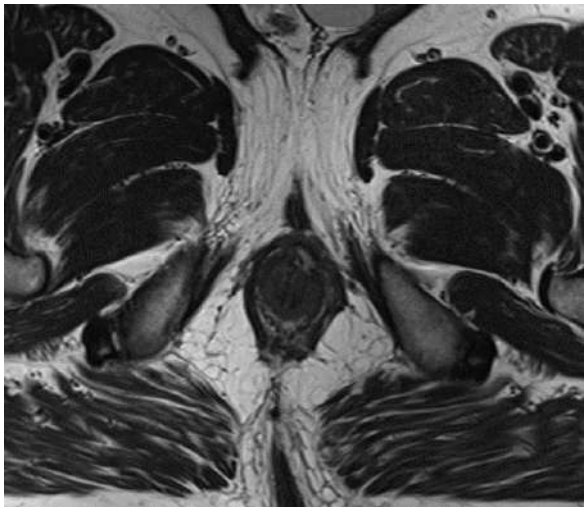
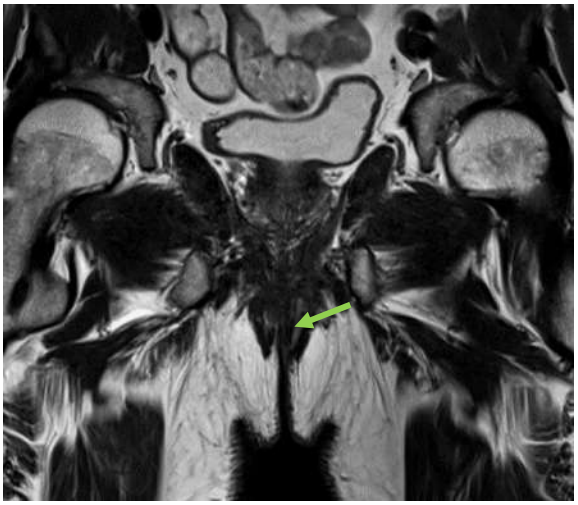




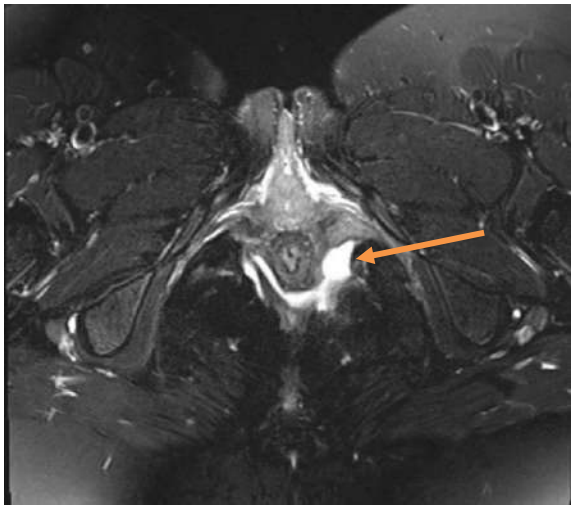
B **C**

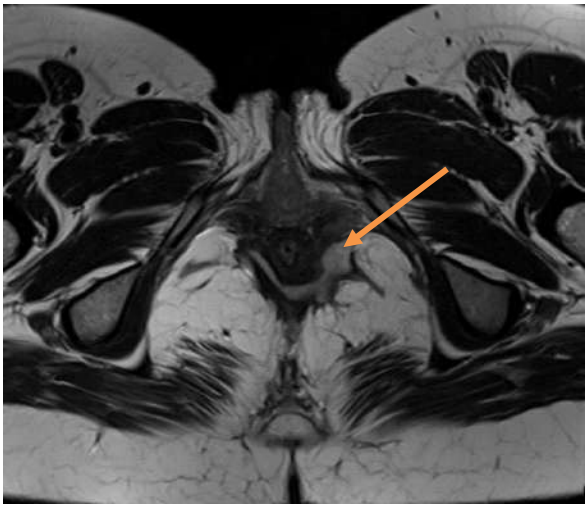
Picture 2 :- A 47 year old male with a history of pus discharge and pain in perianal region

(A) Axial T2 fat sat image (B) Axial T2 wt. images showing T2 hyperintense fistulous tract with the tract seen to pierce the internal sphincter at 1'o clock position (orange arrow).

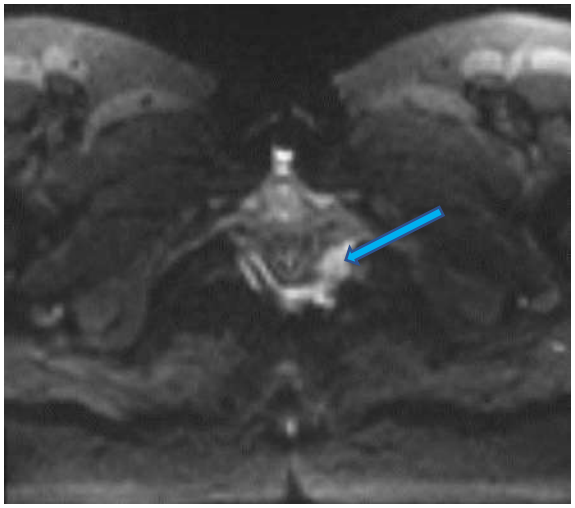
(C) Cor T2 wt. images showing fistulous tract traversing inferiorly in intesphincteric plane to open on left side of natal cleft (green arrow). No ramification or supralevator extension seen

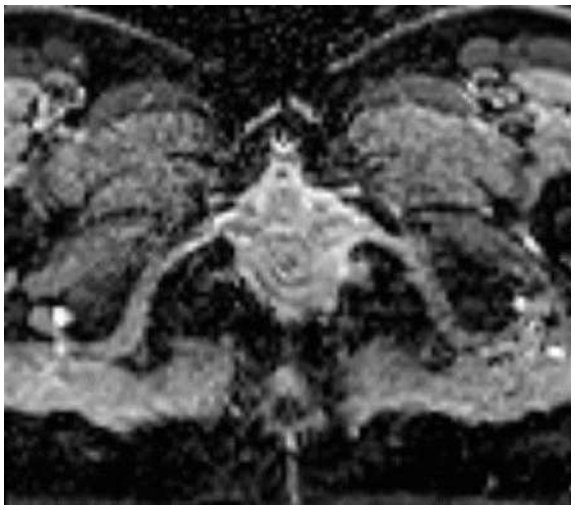
- suggestive of low anterior intersphincetric perianal fistula





A **B**





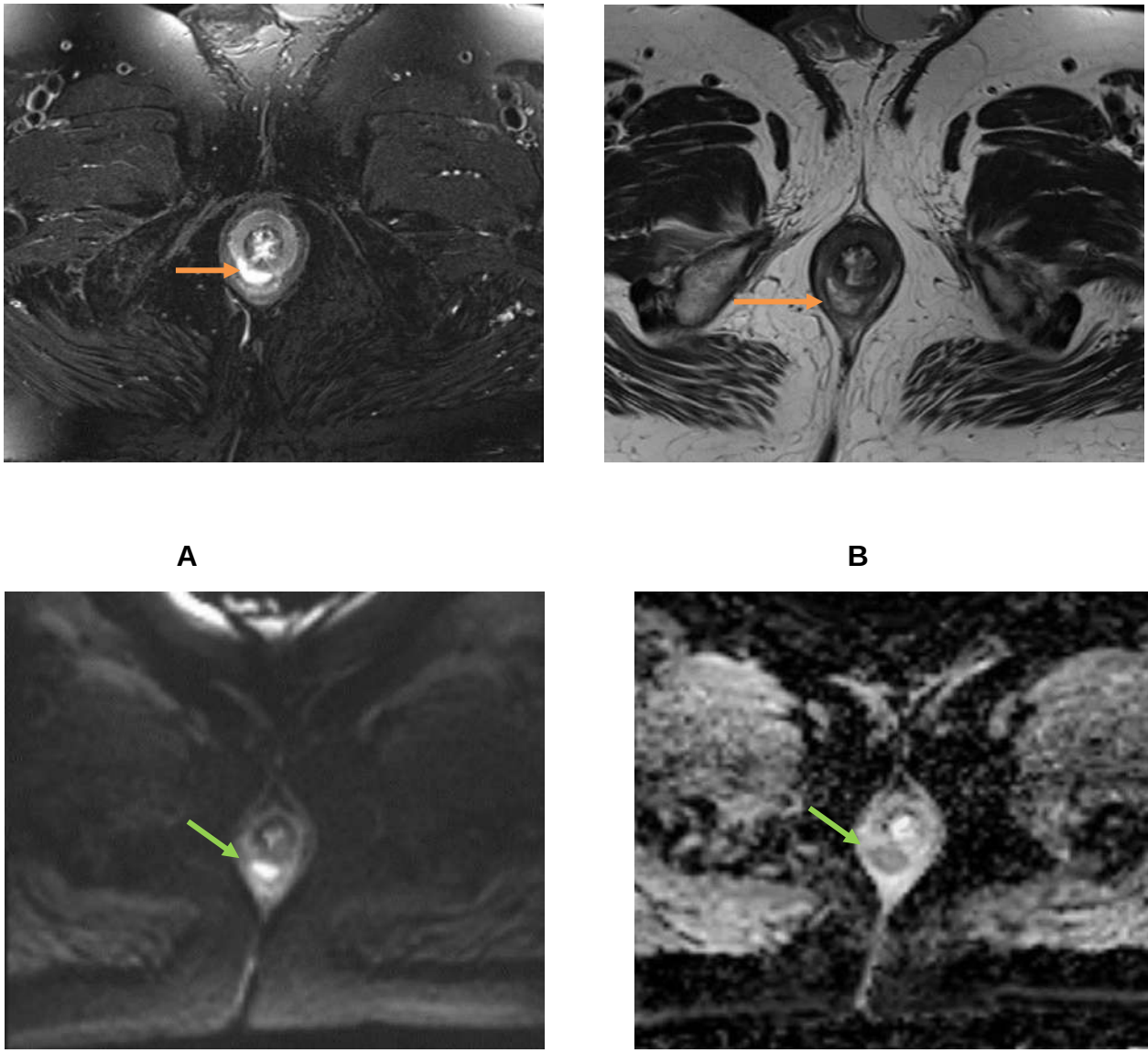
C **D**

Picture 3:- A 32 year old female with a history of pus discharge from perianal region underwent MRI examination.

(A)Axial T2 fat sat image and (B) Axial T2 wt. images showing a horseshoe shaped collection lying in intersphincteric space appearing hyperintense on T2 FS and T2 w. images (orange arrow)

(C) Axial DWI and (D) ADC images reveals abscess showing diffusion restriction on DWI and ADC images (blue arrow)

– suggestive of complex fistula with horseshoe shaped collection in intersphincteric plane



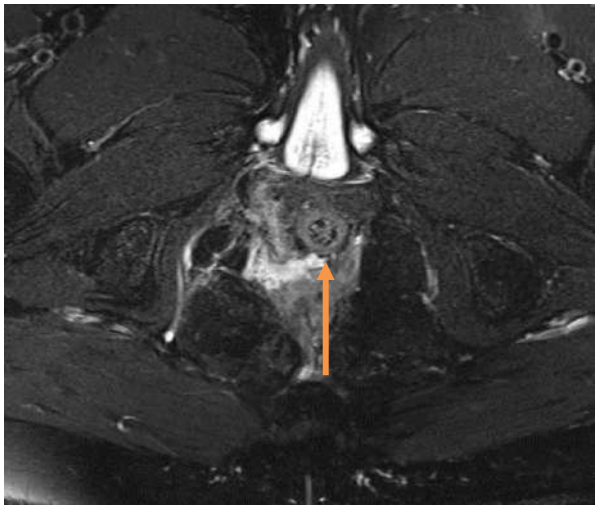
A **B**

C **D**

Picture 4:- A 61 year old male with a history of discharge from perianal region along with swelling and pain

(A)AxialT2 fat sat image, (B) Axial T2 wt. image, (C) Axial DWI and (D) ADC images showing a small horseshoe shaped collection appearing hyperintense on T2 FS and T2 images and showing diffusion restriction on DWI and ADC images (green arrow) in intersphincteric plane extending between 6-9'o clock position with internal opening at 7'o clock position (orange arrow)

–suggestive of complex inter sphincteric fistula with small horseshoe abscess in intersphincteric plane



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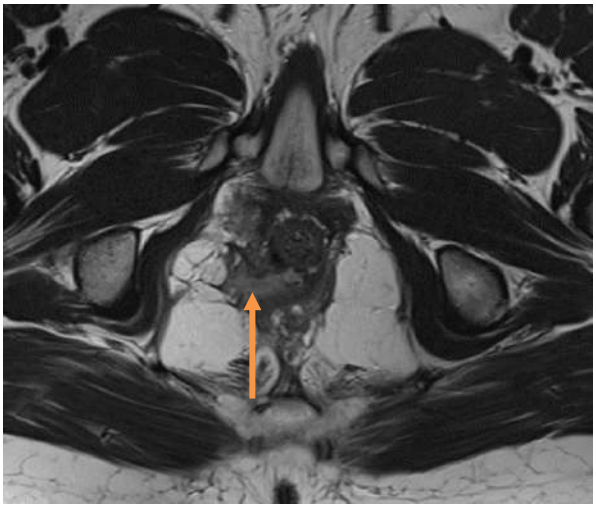
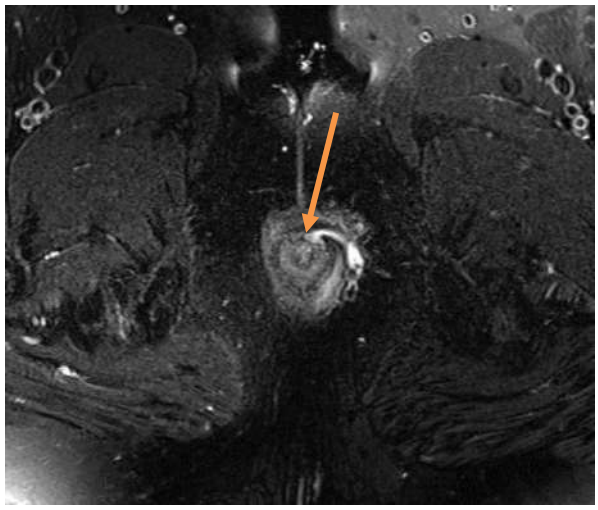


B

C

Picture 5:- A 31 year old male with a history of swelling and pain in perianal region underwent MRI examination.

(A) AxialT2 fat sat image showing T2 hyperintense fistulous tract at 6'0 clock (orange arrow).
(B) Axial T2 wt. images showing T2 hyperintense fistulous tract seen to pierce the external sphincter on the right side (orange arrow).
(C) Cor T2 wt. image showing the tract extending craniocaudally. No ramification/ abscess/ supralevator extension seen (blue arrow)
- suggestive of simple trans sphincteric perianal fistula



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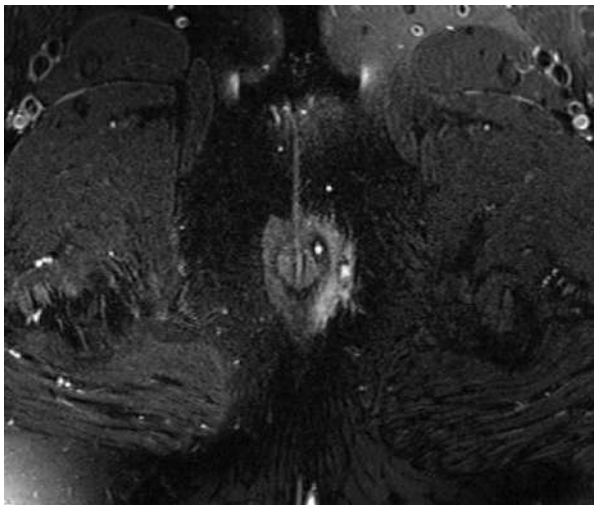

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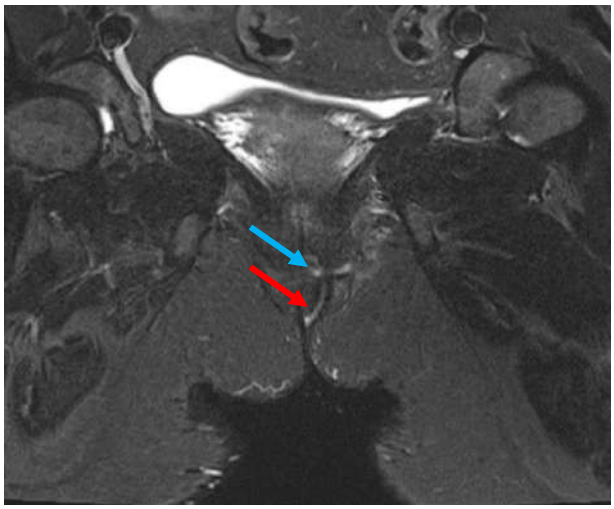

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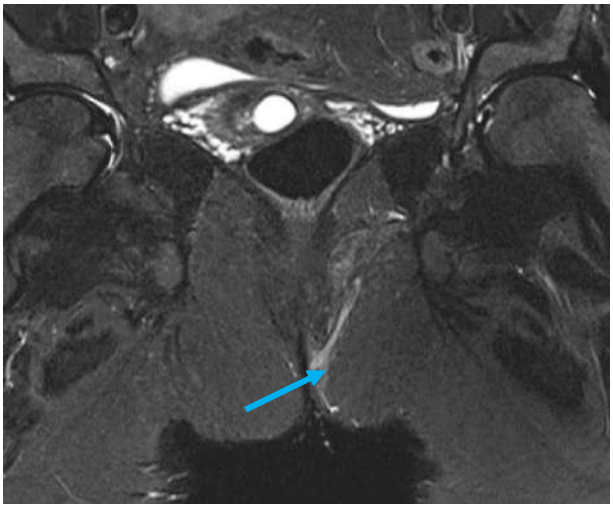
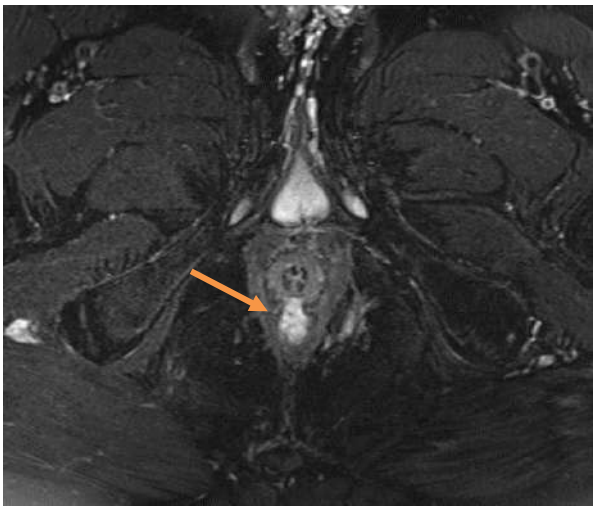


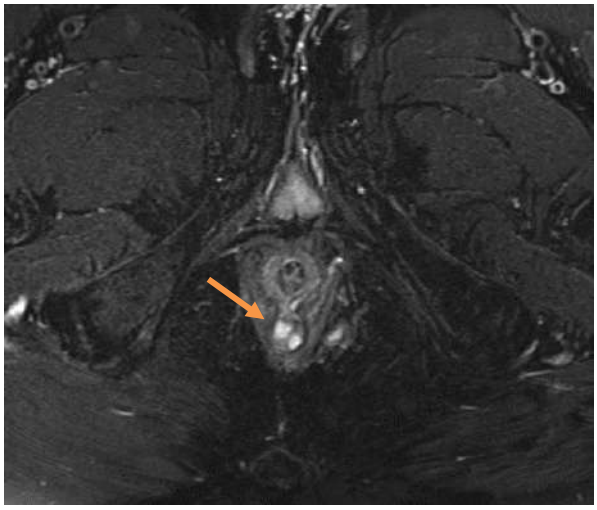
D

Picture 6:- A 47 year old female with a history of pus discharge, swelling and pain in perianal region

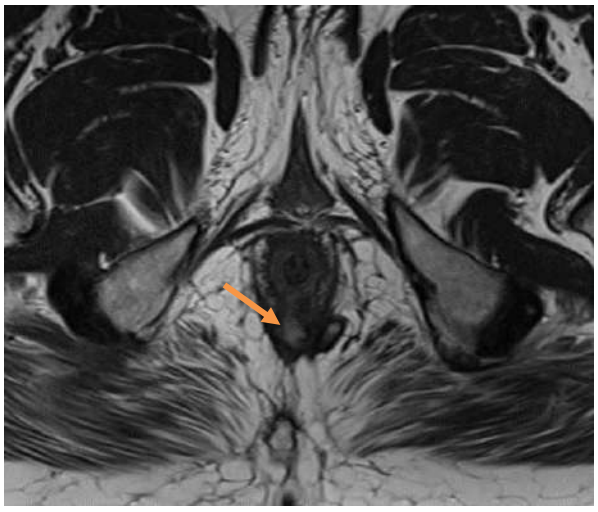
(A) and (B) Axial T2 fat sat images at different levels showing T2 hyperintense fistulous tract with internal opening at 1'o clock position (orange arrow) and is seen to pierce the external sphincter at 2'o clock

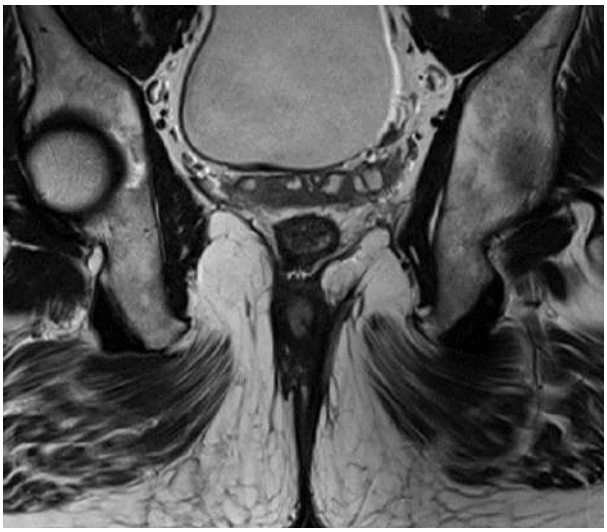
(C) Cor T2 and (D) CorT2 wt. image at different levels show the tract extending inferiorly in the transphincteric plane to open on the left side of the natal cleft (blue arrow) and secondary ramification extending inferiorly in the intersphincteric plane to open on the left natal cleft (red arrow)- s/o complex transphincteric fistula with secondary ramification in intersphincteric plane.





A **B**

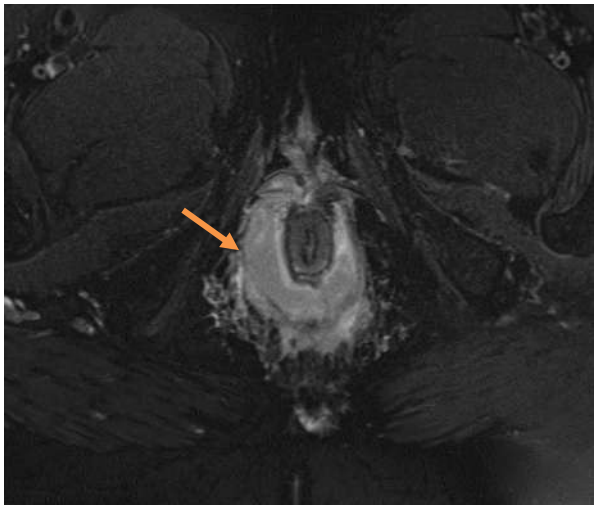




Picture 7:- A 47 year old male with a history of pain and pus discharge from perianal region underwent MRI examination.

(A) And (B)AxialT2 fat sat image at different levels, (C) Axial T2 wt. (D) Cor T2 wt. images showing hyperintense fistulous tract with internal opening at 6'o clock position (orange arrow) with formation of small abscess close to internal sphincter with tract seen extending postero-inferiorly in intersphincteric space and piercing the superficial part of external sphincter with formation of a secondary tract. No supralevator extension seen

- suggestive of complex branching trans sphincteric perianal fistula with intersphincteric space abscess formation



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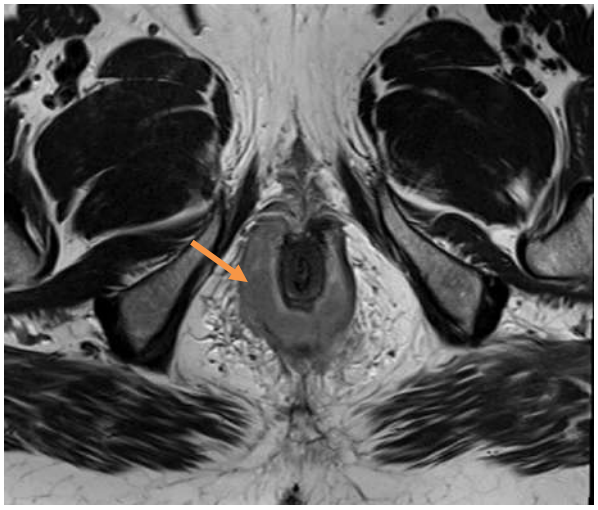

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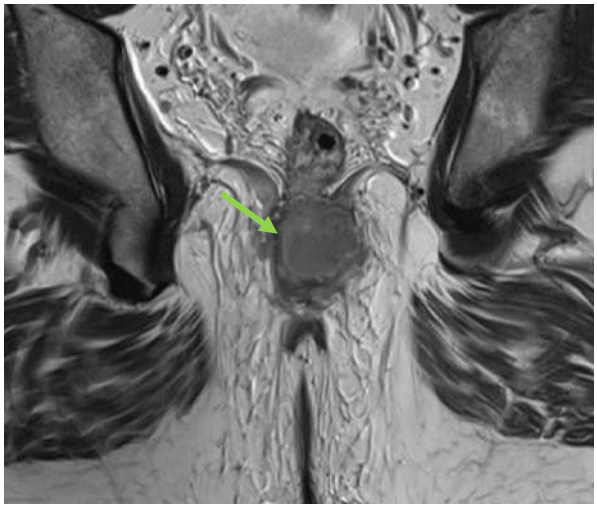

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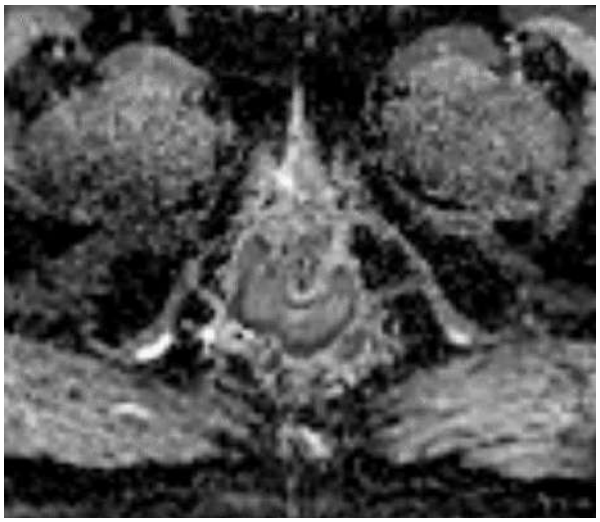
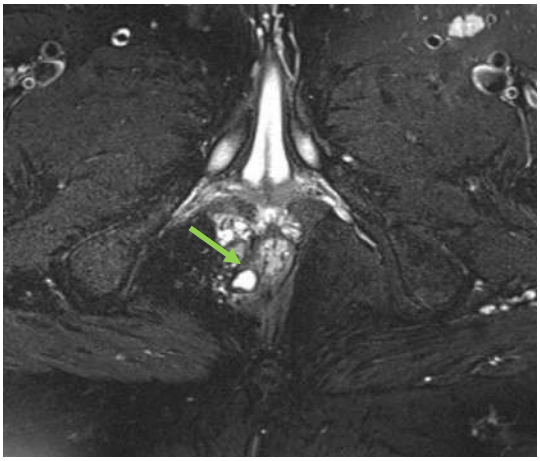


D

Picture 8:- A 57 year old male with a history of pus discharge from perianal region and pain

(A)Axial T2 fat sat image, (B) Axial T2 wt. image, (C) Coronal T2 (D) Axial ADC images showing a large horseshoe shaped abscess showing peripheral diffusion restriction noted extending between 1-11' o clock position seen in intersphincteric plane with involvement of the external sphincter bilaterally (orange arrow), with supralevator extension (green arrow) and inflammation in the mesorectal fat

– suggestive complex fistula with horseshoe abscess with transphincteric and supralevator extension and proctitis



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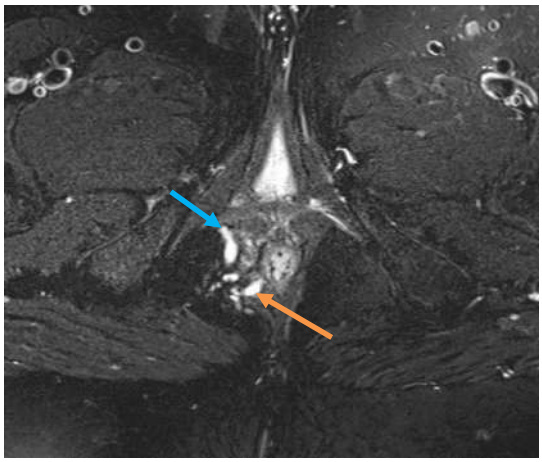
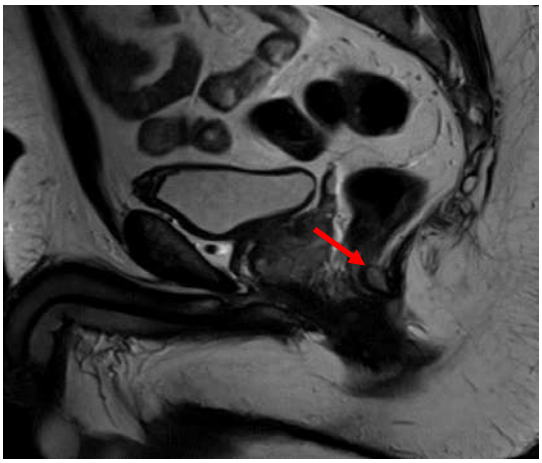


B

C



D

Picture 9:- A 44 year old male with a history of pain in perianal region underwent MRI examination.

(A) and (B) Axial T2 FS images at two different levels showing active intersphincteric fistulous tract (orange arrow) with secondary ramification (blue arrow) and internal opening at 7'o clock position (green arrow)

(C) Cor T2 and (D) Sag T2 wt. images revealing the craniocaudal extent of the secondary ramification extending antero-superiorly along the right puborectalis sling with supralevator extension (red arrow). T2 hypointense fibrotic changes are also seen along the tract

-suggestive of complex branching intersphincteric perianal fistula with supralevator extension

KEY TO MASTER CHART

P- pain

S- swelling

I-itching

F-fever

Ds- discharge

Plt- platelet

Cr- creatinine

T-tenderness

Ex. O. – external opening according to anal clock

In. O. -internal opening according to anal clock

Ex. O. No.- number of external opening

O.F. – other findings

Grade- refers to MR grading according to St James University hospital MR imaging classification of perianal fistula

In. O.- internal opening

Distance In. O.-Distance of internal opening from anal verge (cm)

Distance Ex. O.- Distance of external opening from anal verge (cm)

Wall. E.- wall enhancement

1^0 F.T.- primary fistulous tract

2^0 F.T. & R. – secondary fistulous tract and ramification

Hs- horseshoe component

SL. Ex.- supralevator extension

S.I.- surrounding inflammation

M- midline of natal cleft

SB- scrotal base

R- right of natal cleft

L- left of natal cleft

INTRAOPERATIVE TYPE I- intersphincteric

INTRAOPERATIVE TYPE T- transphincetric

S.NO	MRD	AGE	SEX	P	S	I	Ds	F	OTHER	LAB FINDINGS				CLINICAL EXAMINATION						1° F. T.				
										Hb	WBC	Plt	Cr	S	Ds	T	Ex. O.	Ex. O. No.	O. F.	GRADE	Ex. O.	In.O.	Distance In. O.	Distance Ex O.
1	104364	34	F	+	+	-	-	-	-	9.3	7.2	195	0.51	+	-	+	7	1	-	IV	7	7	3.4	2.7
2	1433394	45	M	+	-	-	+	-	-	12.9	7.8	130	0.71	+	+	+	SB	1	-	I	SB	12	2	9.5
3	1437330	47	F	+	+	-	+	-	-	12.1	9	176	0.6	+	+	+	1,2	2	-	IV	1,2	1	1.4	1.6
4	214424	57	M	+	-	-	+	-	-	11	8.6	342	1.1	+	+	+	5	1	-	II	L	12	1.2	1.1
5	248933	25	M	+	+	-	-	-	-	12.8	10.3	167	0.67	+	-	+	1	1	-	I	11	12	1	4.7
6	1434952	44	M	+	-	+	+	-	-	13.1	7.6	197	0.73	-	-	+	11	1	-	I	R	12	0.8	0.7
7	1588370	34	F	+	+	+	+	-	-	11.9	12	201	0.9	+	+	+	1	1	-	III	L	12	2	5.5
8	1462245	46	M	+	+	-	+	-	-	14	6.5	153	0.57	+	-	+	9	1	-	IV	7	6	1.7	3.2
9	1527525	22	F	+	-	-	+	-	-	10.7	9.2	181	0.4	-	+	+	1	1	-	IV	L	6	1.2	4
10	1685696	44	M	+	-	-	-	-	-	14.2	7.8	242	0.75	-	+	-	1	1	-	III	L	1	0.6	1.2
11	1590414	44	F	+	+	-	+	+	-	12.8	9.6	206	0.6	+	+	+	6	1	-	I	6	6	1.9	0.8
12	1260720	23	M	+	-	+	-	-	-	15.6	6	188	0.62	+	-	+	11	1	-	-	11	-	-	3
13	1149917	37	M	+	-	-	+	-	-	12.9	11	301	0.82	+	+	+	6	1	-	I	5-6	6	1.5	1.2
14	4238	59	M	+	+	-	+	-	-	14.9	7.3	125	0.87	+	+	+	5	1	-	II	L	6	3	6.7-7
15	1642524	43	M	+	-	-	+	-	perianal lesion	14.9	5.1	189	0.61	+	+	+	11	1	-	I	R	12	0.8	5
16	117065	47	M	+	-	-	+	-	perianal lesion	13.8	8.4	213	0.8	-	+	+	12	1	-	I	M	1	1.1	1.2
17	1614615	57	M	+	-	-	-	-	-	13.7	19.5	288	0.97	+	-	+	-	-	-	V	-	6	3.8	-
18	381919	33	M	+	-	-	+	-	-	13.1	10.2	295	0.92	-	+	+	6	1	-	I	6	6	1	1.5
19	1631117	29	M	+	+	-	+	-	-	14.8	7.9	385	0.84	+	+	+	SB	1	-	III	SB	12	1	6
20	1036545	62	M	+	-	-	+	-	-	13.6	4	120	0.94	+	+	+	5	1	-	I	7	7	1.3	1.5
21	1294545	36	M	+	+	-	+	-	-	14.9	6.1	172	1.02	+	+	+	6	1	-	II	M	6	2	1
22	331099	25	M	+	-	-	+	-	-	4.4	8.2	345	0.8	-	+	+	9	1	-	IV	9	12	1.5	4.5
23	1502145	44	M	+	-	-	-	-	-	12.2	12.3	488	0.6	-	-	+	9	1	-	V	R	6	3.7	5.2
24	1305402	20	M	+	+	+	+	-	-	8.1	49.5	120	0.8	+	+	+	1	2	-	I	L	12	1.1	2.2
25	1610836	47	M	+	-	-	+	-	-	12.2	12.3	488	0.68	-	+	+	5	1	-	II	5	6	2.2	2.4
26	1565444	42	F	+	-	-	+	-	-	13.1	7.3	274	0.8	-	+	+	6	1	-	I	M	1	0.5	0.6
27	502948	62	M	+	+	-	+	-	-	11.2	10.3	478	0.61	+	+	+	1	1	-	V	5	5	2.6	2.2
28	135926	33	M	+	-	-	+	-	-	10.6	7.7	533	1.78	-	+	+	SB	1	-	III	SB	1	0.1	3.6
29	1421823	51	M	+	+	-	+	+	-	10.58	7.5	544	1.5	+	+	+	6	1	-	II	M	6	1.9	4.5
30	1536290	31	M	+	+	-	-	-	-	14.2	6.4	249	0.7	+	-	+	9	1	-	III	R	6	2.2	4.6
31	1520139	53	M	+	+	-	+	-	-	13.1	12.3	413	0.82	+	+	+	5	1	-	II	L	6	1.8	2.2
32	1496464	32	F	-	-	-	+	-	-	10.6	10.4	345	0.4	-	+	-	11,2	2	-	IV	R	6	1.3	3
33	1587920	40	M	+	-	-	+	-	-	10.2	11.4	288	0.7	-	+	+	11	1	-	I	R	12	at level of anal verge	3
34	1024405	40	M	+	-	-	+	-	-	13.1	8.2	456	0.98	-	+	+	7	1	-	I	R	6	3	1.2
35	1576797	50	F	+	-	-	+	-	-	14.1	7.2	455	0.96	+	-	+	-	-	-	II	-	12	1.4	-
36	1673695	45	M	+	+	-	-	-	-	13.7	8.6	140	0.6	+	-	+	1	1	-	II	L	-	-	2

S.NO	MRI FINDINGS								COMPARISION OF DIFFERENT MRI SEQUENCES:																	
		2° F. T. & R.			OTHER	ABSCESS			1° F. T.				Ex. O.				In.O.				2° T. & R.				Hs	
	WALL E.	NO.	GRADE	Hs	SL EX.	NO.	WALL E.	S. I.	DWI	T1 PC FS	T2	T2FS	DWI	T1 PC FS	T2	T2FS	DWI	T1 PC FS	T2	T2 FS	DWI	T1 PC FS	T2	T2 FS	DWI	T1 PC FS
1	-	4	1	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
2	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	+	+	-	-	-	-	-	-
3	-	1	I	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
4	-	-	-	-	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	+	+	-	-	-	-	-	-
8	-	1	I	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
9	-	multiple	I	-	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
10	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	+	+	-	-	-	-	-	-
11	+	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
14	-	2	V	-	+	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
15	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	+	+	-	-	-	-	-	-
16	-	1	I	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
17	-	-	-	+	+	2	-	+	+	-	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	-
18	-	1	I	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
19	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
22	-	1	II	-	-	1	-	+	+	-	+	+	-	-	+	+	+	-	+	+	+	-	+	+	-	-
23	-	2	II	-	+	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
24	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
25	-	1	II	-	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
26	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
27	-	-	-	-	+	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
29	-	1	III	+	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-
30	+	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-
31	-	-	-	-	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
32	-	1	II	+	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-
33	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
34	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
35	-	-	-	-	-	1	-	+	+	-	+	+	-	-	-	-	+	-	+	+	-	-	-	-	-	-
36	-	1	I	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	-	-	+	-	+	+	-	-

S.NO											INTRA OPERATIVE FINDINGS								
			SL. Ex.				ABSCESS												
	T2	T2 FS	DWI	T1 PC FS	T2	T2FS	DWI	T1 PC FS	T2	T2 FS	NO. OF PERIANAL FISTULA	TYPE	Ex. O.	In. O.	Dstance In. O.	2^{o} F. T. NO.	Hs	SL. Ex.	ABSCESS(+/-)
1	-	-	-	-	-	-	-	-	-	-	1	T	7	-	-	1	-	-	-
2	-	-	-	-	-	-	-	-	-	-	1	I	SB	12	3	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	multiple	T	1,2	1	1	1	-	-	-
4	-	-	-	-	-	-	+	-	+	+	1	I	5	12	1.2	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	1	I	1	12	1	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	1	I	11	12	1.2	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	1	T	1	12	2.5	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	1	T	7	6	2 cm above anal verge	-	-	-	-
9	-	-	-	-	-	-	+	-	+	+	1	T	1	6	1.5	2	-	-	+
10	-	-	-	-	-	-	-	-	-	-	1	T	1	1	0.7	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	1	I	6	6	2	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	1	I	11	-	0.6	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	1	I	6	6	1.5	-	-	-	-
14	-	-	+	-	+	+	-	-	-	-	1	T	5	midline low rectum 6'o clock	3.3	2	-	+	-
15	-	-	-	-	-	-	-	-	-	-	1	I	11	12	0.7	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	1	I	1	1	1.3	-	-	-	-
17	+	+	+	-	+	+	+	-	+	+	1	T	-	6	3.7	-	+	+	+
18	-	-	-	-	-	-	-	-	-	-	1	I	6	6	1	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	1	T	1	12	1	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	1	I	7	7	1.5	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	1	I	6	6	1.8	-	-	-	-
22	-	-	-	-	-	-	+	-	+	+	1	T	9	12	1.6	1	-	-	+
23	-	-	+	-	+	+	-	-	-	-	2	branching	9	6	3.5	2	-	+	-
24	-	-	-	-	-	-	-	-	-	-	2	I	1	12	1	-	-	-	-
25	-	-	-	-	-	-	+	-	+	+	1	I	5	6	2	1	-	-	+
26	-	-	-	-	-	-	-	-	-	-	1	I	6	1	0.5	-	-	-	-
27	-	-	+	-	+	+	+	-	+	+	1	I	5	6	2.5	-	-	+	+
28	-	-	-	-	-	-	-	-	-	-	1	I	1	1	2	-	-	-	-
29	+	+	-	-	-	-	+	-	+	+	1	I	6	6	2	1	+	-	+
30	-	-	-	-	-	-	-	-	-	-	1	T	9	6	2.5	-	-	-	-
31	-	-	-	-	-	-	+	-	+	+	1	I	5	6	2	-	-	-	+
32	+	+	-	-	-	-	+	-	+	+	2	T	11,2	6	1.2	1	+	-	+
33	-	-	-	-	-	-	-	-	-	-	1	I	11	11	at level of anal verge	-	-	-	-
34	-	-	-	-	-	-	-	-	-	-	1	I	7	6	3	-	-	-	-
35	-	-	-	-	-	-	+	-	+	+	1	T	-	12	1.5	-	-	-	+
36	-	-	-	-	-	-	-	-	-	-	2	I	1	12	1	1	-	-	-

S.NO	MRD	AGE	SEX	P	S	I	Ds	F	OTHER	LAB FINDINGS				CLINICAL EXAMINATION						1^{O} F. T.				
										Hb	WBC	Plt	Cr	S	Ds	T	Ex. O.	Ex. O. No.	O. F.	GRADE	Ex. O.	In.O.	Distance In. O.	Distance Ex O.
37	1606994	68	M	+	-	-	+	-	-	12.8	11.4	386	0.8	+	+	+	6	1	-	I	M	6	1	4.4
38	1694661	48	M	+	+	-	+	-	-	13.8	4.4	181	0.9	+	+	+	12	1	-	I	R	11	1.1	2.6
39	1665738	36	F	+	-	-	-	-	-	12.8	4.2	180	0.6	-	-	+	6	1	-	I	M	6	2.5	0.5
40	1472183	68	M	+	-	-	+	-	redness	13.8	9	200	1.2	+	+	+	6	1	redness	I	6	5	2.1	1.5
41	1544231	49	M	+	+	-	-	-	-	14.6	8.1	204	1	+	-	+	-	-	-	IV	-	12	4	-
42	1475655	25	M	+	+	-	+	-	-	13.3	6.8	196	0.8	+	+	+	11	1	-	III	11	-	-	1.2
43	1516647	36	M	+	+	-	+	-	-	14.8	6.8	169	1	+	+	+	4	1	-	IV	L	6	1.8	4.7
44	1686749	50	M	+	-	-	+	-	-	11.2	7.3	200	1	-	+	+	7	1	-	I	R	7	1.3	1.4
45	1661156	61	M	+	+	-	+	-	-	11.6	6.1	220	0.8	+	-	+	7	1	-	II	R	7	2	1.2
46	1688430	43	M	+	-	-	+	-	-	13.5	7.9	250	1	-	+	+	6	1	-	II	R	6	2	1
47	1685408	27	F	-	+	-	-	+	-	13.4	8.9	250	0.6	+	-	+	1	1	-	II	L	6	2	1.7
48	1627851	40	M	+	+	-	+	-	-	12	7.1	165	0.8	+	+	+	11	1	-	I	R	10	1.3	4.3
49	1690843	71	M	+	+	-	-	-	-	11	12.4	559	1.2	+	+	+	-	-	-	IV	-	11	3.5	-
50	1660213	66	M	+	-	-	+	-	-	12.2	6.9	243	1.4	-	+	+	11	1	-	I	R	12	0.1	4.5

S.NO	MRI FINDINGS								COMPARISION OF DIFFERENT MRI SEQUENCES:																	
		2° F. T. & R.			OTHER	ABSCESS			1° F. T.				Ex. O.				In.O.				2° T. & R.				Hs	
	WALL E.	NO.	GRADE	Hs	SL EX.	NO.	WALL E.	S. I.	DWI	T1 PC FS	T2	T2FS	DWI	T1 PC FS	T2	T2FS	DWI	T1 PC FS	T2	T2 FS	DWI	T1 PC FS	T2	T2 FS	DWI	T1 PC FS
37	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	+	+	-	-	-	-	-	-
39	+	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	-	-	-	-	-
41	-	-	-	-	-	1	-	+	+	-	+	+	-	-	-	-	+	-	+	+	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-
43	-	2	IV	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-
44	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-
45	-	-	-	+	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	+	-
46	+	-	-	-	-	1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-
47	-	-	-	+	-	1	-	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	+	-
48	-	-	-	-	-	-	-	-	+	+	+	+	-	+	+	+	+	-	+	+	-	-	-	-	-	-
49	+	-	-	+	-	1	+	+	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	-	+	+
50	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	-

S.NO											INTRA OPERATIVE FINDINGS								
			SL. Ex.				ABSCESS												
	T2	T2 FS	DWI	T1 PC FS	T2	T2FS	DWI	T1 PC FS	T2	T2 FS	NO. OF PERIANAL FISTULA	TYPE	Ex. O.	In. O.	Dstance In. O.	2^{o} F. T. NO.	Hs	SL. Ex.	ABSCESS(+/-)
37	-	-	-	-	-	-	-	-	-	-	1	I	6	6	1	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	1	I	12	11	1.1	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	1	I	6	6	2.5	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-	1	I	6	6	2	-	-	-	-
41	-	-	-	-	-	-	+	-	+	+	1	T	-	12	4.2	-	-	-	+
42	-	-	-	-	-	-	-	-	-	-	1	T	11	-	1.3	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	1	T	8	6	1.8	2	-	-	-
44	-	-	-	-	-	-	-	-	-	-	1	I	7	7	at the edge of anal verge	-	-	-	-
45	+	+	-	-	-	-	+	-	+	+	1	I	7	6	2	-	+	-	+
46	-	-	-	-	-	-	+	+	+	+	1	I	6-7	6-7	2	-	-	-	+
47	+	+	-	-	-	-	+	-	+	+	1	I	1	6	2	-	+	-	+
48	-	-	-	-	-	-	-	-	-	-	1	I	11	10	1.2	-	-	-	-
49	+	+	-	-	-	-	+	+	+	+	1	T	-	11	3.5	-	+	-	+
50	-	-	-	-	-	-	-	-	-	-	1	I	11	12	0.1	-	-	-	-

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Tele/Fax : 01639-256235
Email – Thesisbfuhs@gmail.com

55

No. BFUHS/2K23p-TH/ 40 Date 1/1/24

The Principal
Dayanand Medical College & Hospital
Ludhiana

Subject:: Approval of Plan of Thesis.

This is to inform you that the Faculty of Medical Sciences in its meeting held on 25.09.2023 has approved the plan of thesis of **Amanpreet Kaur Sekhon**, a student of your college for **MD Radio-diagnosis** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Role of mri in assessment of perianal fistula .

Supervisor
Dr. Ritu Dhawan Galhotra
Assoc. Prof.,
Dept. of Radio-diagnosis

Co-Supervisor:-
Dr. Amandeep Singh Nar
Assoc. Professor
Dept. of Surgery

The student may submit the thesis in triplicate alongwith the plan in triplicate also, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*

ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF MEDICINE

IN

RADIO-DIAGNOSIS

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

AUGUST, 2022

DR. AMANPREET KAUR SEKHON

DEPARTMENT Of RADIO-DIAGNOSIS
DAYANAND MEDICAL COLLEGE & HOSPITAL,
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA
For the degree of	MD Radiodiagnosis
Name of the candidate	Dr. Amanpreet Kaur Sekhon
Supervisor	Dr. Ritu Dhawan Galhotra, Associate Professor, Department of Radiodiagnosis, DMCH, Ludhiana
Co-supervisor(s)	Dr. Amandeep Singh Nar, Associate Professor, Department of Surgery, DMCH, Ludhiana
Institution	Dayanand Medical College and Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

INTRODUCTION: Perianal fistula is an uncommon process, with a prevalence of 0.01%. It predominantly affects young males, with male-to-female ratio of 2:1. Most commonly it presents with discharge and local pain due to inflammation. Although surgery is the definite treatment of perianal fistula, however successful surgical management depends upon accurate preoperative assessment with location of track, internal opening, abscess formation or secondary track formation.

MRI owing to its high soft tissue resolution and multiplanar imaging capability allows accurate assessment of perianal fistula, also gives information regarding anatomical relations between fistula and anal sphincter complex. Thus, it is gold standard and best investigation for preoperative assessment of perianal fistula.

AIM OF STUDY: 1. To compare the predictability of different MRI sequences.
2. To evaluate the role of MRI in assessment of perianal fistula and its correlation with per operative findings.

MATERIALS AND METHODS: This prospective study will be conducted from 15 September 2022 to 15 March 2024 on patients referred for MRI perineum to the department of Radio-diagnosis, Dayanand medical college & hospital, Ludhiana.

CLINICAL SIGNIFICANCE: To assess the perianal fistula, to improve its overall surgical outcome, reduce the morbidity, recurrence and post op complications such as fecal incontinence.

KEYWORDS: perianal fistula, MRI fistula

Amanpreet Kaur Sekhon
(Signature)
Candidate

(Signature)
Co-supervisor

(Signature)
Supervisor

(Signature)
Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA"** exist in the Department of Radiodiagnosis, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. Ritu Dhawan Galhotra
Professor
Department of Radiodiagnosis
DMCH, Ludhiana

Co-Supervisor

Dr. Amandeep Singh Nar
Associate Professor
Department of Surgery
DMCH, Ludhiana

Head of the Department

Dr. Kavita Saggar
Professor & Head
Department of Radiodiagnosis
DMCH, Ludhiana

Place : _____

Date : _____

APPROVAL PROFORMA
BYRESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Amanpreet Kaur Sekhon
Department	Radiodiagnosis
Topic of Thesis	ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA
Likely date of appearing in PG examination	May, 2024
Date of enrollment	February 15, 2022
Name of Head of Department	Dr. Kavita Saggar
1) Supervisor **2) Co-Supervisor(s)**	Dr. Ritu Dhawan Galhotra Dr. Amandeep Singh Nar
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / ~~No~~

Dr. Sandeep Puri
Chairperson
Research Committee
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairperson
Ethics Committee
Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	Dr. Amanpreet Kaur Sekhon Kailpur Road, Adda-Dakha, P.O. Mandi Dakha, Mullanpur, Ludhiana, 141101.
2	NAME OF THE INSTITUTE	Dayanand Medical College & Hospital, Ludhiana
3	COURSE OF STUDY AND SUBJECT	M.D. Radiodiagnosis
4	DATE OF ADMISSION OF COURSE	15 February, 2022
5	TITLE OF THE TOPIC	ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Perianal fistula is an abnormal connection between the anal canal and the skin of the perineum. Most commonly it presents with discharge (65% of cases) and local pain due to inflammation.[1] Most perianal fistulas primarily occur as a result of an anal gland infection which leads to fistulous tract and abscess formations. According to the theory of cryptoglandular hypothesis, it occurs due to the obstruction of a draining duct at the level of the dentate line in the mid-anal canal.[2]

There are numerous secondary causes of perianal fistulas which include, several inflammatory conditions such as tuberculosis, Crohn's disease, pelvic infection, diverticulitis, trauma during childbirth, pelvic malignancy, and radiation.[2]

Diagnostic methods of imaging perianal fistulas include retrograde fistulography, anal endosonography, computed tomography (CT) fistulography, and magnetic resonance imaging (MRI)

In the earlier days, fistulography was conducted to study the anatomy of the fistula using x-ray imaging. It was a complicated procedure that involves the slow injection of contrast into the external opening, to avoid any tissue disruptions. The slow injection of contrast may image the primary tract but it failed to fill any secondary extensions. This method was also not able to explain the perianal anatomy, making it difficult to determine the course or location of the tract. It is a highly invasive procedure, and the chances of sepsis were also high.[3-4]

Anal endosonography was also insufficient for clinical assessment of the perianal fistula as it was unable to recognize the deep-seated infection. Due to its limited field of view, it was difficult to follow the whole course of transsphincteric or suprasphincteric fistulas. It was also not possible to differentiate between the areas of fibrosis and infection, which is particularly important in cases of recurrent fistulas, as both appear hyperechoic on endosonography.[5]

Computed tomography, as a method of imaging fistulas also provides limited information. Through non-ionic water-soluble contrast inserted per rectum or through the external opening, it can identify the existence

of fistulous tracks but is not accurate for a detailed analysis of fistulous anatomy to classify it. Moreover, it was difficult to characterize the sphincters, levator ani, and fibrous fistulous tract accurately because of their similar attenuation values.[6]

Magnetic resonance (MR) imaging is now increasingly recognized as and an emerging technique to access the perianal fistula. Due to the use of non-ionizing radiation and high contrast resolution, it is widely used in the identification and diagnosis of all types of fistulas. The procedure is preferential as it has 96% sensitivity and 100% specificity for primary fistula and internal opening identification. Complex fistula tracts, infected tracts, and abscess formations are also easily imaged with MR, with 100% sensitivity and specificity.[7] Furthermore, it can provide detailed anatomic descriptions of the relationship between the fistula and the anal sphincter complex. This thereby allows surgeons to correctly choose the best surgical treatment road map to reduce the recurrence and post-surgery complications, such as fecal incontinence.[8-9]

MRI imaging of perianal fistulas relies on the inherent high soft tissue contrast resolution and the multiplanar display of anatomy. Various studies have suggested that MRI is even more sensitive than the surgical exploration of the tract.

Hence, due to its accuracy, non-invasiveness, and the use non ionizing radiation, it has become the primary choice of investigation for diagnosis and evaluation of perianal fistulas.

6.2 REVIEW OF LITERATURE

1. Al-Khawari H. A (2005) carried out a study to evaluate the role of magnetic resonance imaging (MRI) in preoperative assessment of fistula-in-ano. In this study, twenty-six patients (21 males and 5 females, aged 19-65 years) were prospectively studied from July 1999 to December 2001 using a 1.0-tesla superconducting magnet. T (1)-weighted fast spin echo (T1W FSE) images before and after gadolinium injection and fat-suppressed T2-weighted fast spin echo (T2W FSE) images were obtained in transverse and coronal planes. Following this, MRI findings were correlated with surgical findings. It was concluded that twenty-one of the 26 patients had active fistulas. The MRI findings were as per the examination findings under anesthesia and/or surgery in 15 of 16 cases. Both coronal and transverse planes were useful in assessing the location and direction of tracts and abscesses. It was noted that both contrast-enhanced T1W FSE and fat-suppressed T2W FSE images were useful in assessing the course of tracts and the activity of lesions. Hence, MRI showed an accurate correlation with surgical findings and aided in preoperative management and planning for surgery.[10]

2. Nalan Yildrium et al (2012) conducted a study to determine the type of perianal fistula and obtain critical information for surgical decisions, and also to define the optimal combination of sequences for readers with varying levels of experience with the help of various magnetic resonance imaging (MRI) sequences. 33 MRI examinations in 26 patients with suspected perianal fistula were included. The following sequences were obtained in both the coronal and axial planes: thin slice, high-resolution T1-weighted (W) spin echo; T2-weighted turbo spin echo; short tau inversion recovery (STIR); and native and contrast-enhanced T1-weighted gradient echo fast low-angle shot (FLASH) images with fat suppression (FS-CE-T1W-GRE). The examinations were interpreted by three radiologists and seventeen of the patients underwent surgery. The surgical findings and the MRI results were evaluated. A statistically significant concordance between the fistula classification and surgery was achieved with the FS-CE-T1W-GRE

sequence for Reader 1 (Cramer's V=0.701, P = 0,022) and Reader 3 (Cramer's V=0.716, P = 0,043). For Reader 2, statistically significant concordance between fistula classification and surgery was achieved with the FS-CE-T1W-GRE (Cramer's V=0.703, P = 0,011) and the T2W images (Cramer's V=0.648, P = 0,027). For all sequences, there was statistically significant agreement between readers for fistula classification, internal opening location, and the presence of sinus tracts, abscess, a horseshoe component, and inflammation. It was concluded that the combination of FS-CE-T1W-GRE images with either T2W or STIR images collected in both the coronal and axial planes was sufficient to assess before deciding the surgical extent of the procedure.[11]

3. Mahmoud E.Agha et al (2013) did the study which aims not only to determine the value of preoperative MRI of perianal fistula but also to detect MRI fallacious results if any. Also, it aims to suggest how we can limit such false positive MRI results that may lead to unnecessary surgery. A prospective comparative study included 100 patients was done. Fifty of them (group A) were operated on following the guidance of preoperative MRI, while the other 50 patients (group B) were directly operated on without MRI. Results were obtained which showed that group A: surgically proven 24 patients grade 1, 13 grade 2, 4 grade 3, 4 grade 4, and 3 grade 5. MRI grading was 26 grades I, 13 grade 2, 4 grade 3, 4 grade 4, and 3 grade 5. Two patients were false positive. Postoperative complications: 2 recurrences, 1 incontinence, and 1 both recurrence and incontinence. Group B: surgically proven 22 patients grade 1, 11 Grade 2, 8 grade 3, 3 grade 4, and 3 grade 5. Clinical preoperative grading was 42 patients with grade 1 and 8 grade 2. Three patients were false positives. Postoperative complications: 17 recurrences, 6 incontinence, 3 concomitant recurrences, and incontinence. The conclusion was made that MRI is a very helpful tool for preoperative imaging of perianal fistula. Its fallacious preoperative positive results may lead to unnecessary surgeries which can be corrected by standardizing IV gadolinium contrast as routine protocols

or using complementary Color Doppler US examination of the fistulous track.[12]

4. Kulwinder Singh et al (2014) did a study that aimed to evaluate the role of Magnetic Resonance Imaging in the detection and characterization of perianal fistulae and further correlate it with surgical findings. They selected fifty consecutive patients with suspected perianal fistulae having one or more external openings for a prospective study of MRI evaluation. Previously operated patients or patients with the recurrent perianal disease were excluded from the study. The surgical correlation was done with MRI findings, which were recorded according to "St. James's University Hospital MR Imaging Classification of Perianal Fistulae". Finally, a comparison between T2-weighted fat-saturated and postcontrast T1-weighted fat-saturated sequences was done. Perianal fistulae perioperatively in 45 patients were confirmed amongst a total of 50 patients. The sensitivity and specificity of MRI in correctly detecting and grading the primary tract were found to be 95.56% and 80% respectively; for abscess, it was 87.50% and 95.24% respectively. High sensitivity was also discerned in the identification of the secondary tract (93.75%), correct localization of internal opening (95.83%), and correctly detecting the horse-shoeing (87.50%). Our assumption of the null hypothesis was accepted by comparing the results of T2-weighted fat-saturated sequences and postcontrast T1-weighted fat-saturated sequences. Magnetic Resonance Imaging (MRI) was highly accurate in the assessment of surgically important parameters (primary tract and its grading, internal opening, secondary tract, abscess, horseshoeing) of perianal fistulae. Comparison of results of imaging findings on T2-weighted and postcontrast T1-weighted fat-saturated sequences were statistically similar, so contrast study can be omitted, particularly while evaluating primary / previously unoperated perianal fistulae.[13]

5. Dr. Muhammad Fahim Amjad and Dr. Abdul Nasir Muhammad (2015) conducted a prospective study to assess the role of MRI in the detection and classification of Perianal Fistula and the correlation of preoperative MRI findings with the findings on surgery in the

department of Radiology King Khalid Civilian Hospital Tabuk Kingdom of Saudi Arabia. The study was conducted for two years between February 2013 and February 2015. In this study, 60 patients were referred from the surgical department for evaluation of the Perianal fistula by MRI during the above-mentioned period and MRI was performed on 48 Patients. (42 males and 6 Females) using a variety of MRI sequences. Fistulas were classified according to SJUH (St James's University Hospital classification MR imaging-based grading system) and MRI findings of individual MRI sequences used were correlated with operative findings. It was found that the most common fistula was Grade 1 (37.5%). In the majority of the cases, an internal opening was found at the 6' O clock position. Post intravenous contrast-enhanced Axial and coronal oblique (CE FST1WFSE) Fat suppressed T1 weighted Fast spin echo and Axial and coronal Fat suppressed T2W FSE sequence (FST2WFSE) showed the highest Accuracies of 98.13% and 97.06% respectively in the diagnosis of anorectal fistulae. MRI should be used as a first-line imaging modality in the preoperative assessment of the Perianal fistula. Findings on Axial and coronal oblique CE FST1WFSE, and axial and coronal oblique FST2WFSE showed excellent agreement with the surgical findings. By using MRI as the first line imaging modality in the evaluation of Perianal Fistula one can percept the best possible surgical management resulting in the prevention of residual/ recurrence disease and complications such as fecal incontinence.[14]

6. Narvir Chauhan and Dinesh Sood (2016) did a prospective hospital-based study for a period of one year from April 2014 to April 2015 in the departments of Radiodiagnosis and Surgery of our institute. A total of 50 consecutive patients presenting with perianal fistulous disease fulfilling the inclusion and exclusion criteria were included in the study and taken up for MRI. The perianal fistulae were classified according to St James University hospital classification and tracks were assessed about the anatomical plane, length, ramifications, abscess formation, enteric communication, external cutaneous opening, enhancement, and suprasphincteric extension. The surgical correlation

was done in 31 patients, who opted for surgical treatment, and the rest of the 19 patients preferred alternative medicine for treatment or chose to postpone their surgery. Results were obtained which revealed that the disease was much more prevalent in males in comparison to females with a male-to-female ratio of 24:1. Grade 4 was the most common type of fistula (34%) while Grade 5 was the least common type (4%). MRI showed a high sensitivity of 93.7% and a positive predictive value (PPV) of 96.7% when correlated with surgical findings. A substantial number of patients (38%) preferred alternative medicine or a non-surgical form of treatment. The conclusion was made that MRI is a very sensitive modality for the evaluation of perianal fistula. In our study group, the disease predominantly affected middle-aged men. Ramifications and abscesses were commonly seen, affecting nearly half of the patients, and the majority of the patients had active fistulous tracks with the posteriorly located enteric opening. Overall, transsphincteric fistulae were the most common. A significant number of patients avoided surgery or showed a preference for non-surgical treatment.[15]

7. Nasreen Mohey and Tamir A. Hassan (2017) carried out a prospective study on 30 patients in the age range of 14–44years. Preoperative MR grading was correlated with surgical outcomes. The sensitivity, specificity, PPV, NPV, and weighted Kappa of MR grading in correlation with surgery was 95.8%, 83.3%, 95.8%, 83.3%, and 0.79 respectively with P value=0.000MRI is a valuable modality for grading of primary perianal fistula and its complications. Accurate pre-operative grading may reduce the surgical complications and possibility of recurrence.[16]

8. Milind Sawant et al (2017) conducted a study to evaluate the accuracy and predictive values of pre-operative MRI in diagnosing the severity of perianal fistulas and the conditions associated with it like internal anal opening, secondary tract, abscess, and supra levator extension. In this study, 44 patients with clinically suspected perianal fistulas underwent MRI for the evaluation of the severity and presence

of the associated conditions by using the grading system of St James's University Hospital Classification. Pre-operative MRI grading was compared with the surgical findings in the 26 operated patients. Out of 44 clinically suspected perianal fistulas, 41 (93%) were diagnosed as perianal fistulas by MRI. The most common type was grade 1 seen in 12(27.3%) patients followed by grade 4 fistula seen in 10(22.7%) patients. All 26 patients were evaluated by surgical findings for the severity of perianal fistulas and were found to be graded in identical grades by pre-operative MRI. MRI was 100% sensitive in picking up all five grades. It was concluded that MRI helps in the accurate delineation of the fistulous tract, identification of secondary tract, and abscess.[17]

9. SurjaKumar et al (2018) did a prospective study on patients with perianal fistulae to correlate clinical examination and operative findings with the findings of MRI and to draw the efficacy of MRI as a preoperative diagnostic tool in the management of fistula in ano. It was performed at the Surgery Department and MRI unit of the Radiology Department of JLNH and RC, Bhilai, from January 2014 to July 2015. All patients underwent high-spatial-resolution MR imaging. MR imaging findings were correlated with the intraoperative surgical finding. MR imaging shows 7 fistulous patients with side branching and 16 with abscess cavities which were 100% intraoperatively correlated. Fifty-six patients out of 60 completely correlated with MRI for the primary track which was clinically significant. MRI had 96% sensitivity and 100% specificity for primary tract and internal opening and 100% sensitivity and specificity for abscess and multiple tracks. The conclusion was made as MRI is successful in the treatment of perianal fistulae by providing more accurate anatomical information about the amount of sphincter above the track and the position and level of the internal opening, thereby increasing the likelihood of successful surgical treatment. So, MRI is a very important preoperative investigation tool for fistula in ano.[18]

10. Duc Vo et al (2019) carried out a study that aimed to determine the role of magnetic resonance imaging (MRI) in diagnosing and describing the characteristics of fistula-in-ano, and the agreement between MRI and operative findings. A retrospective study in 367 patients with fistula-in-ano who were diagnosed and had an operation at the University Medical Center between January 2016 and January 2018 was conducted. After evaluating MRI findings, it was then compared with surgical findings using the kappa coefficient (k) method. 367 patients were studied (327 males and 40 females, mean age 39.3 ± 12.4 years). A total of 411 primary fistulas were found during surgery. There was a strong agreement between MRI and surgery for classifying primary tracts (k = 0.89) and detecting secondary tracts (k = 0.94). While the sensitivity and specificity of MRI for detecting internal openings were 99% and 85.2% respectively; these rates were 100% for abscesses. Both T2-weighted turbo spin-echo (T2W TSE) and postcontrast fat-saturated T1-weighted turbo spin-echo (FS T1W TSE) sequences showed high sensitivity (96.6% and 98.4% respectively) and specificity (92.6% and 81.5% respectively) for depicting internal openings and secondary tracts. Post-contrast FS T1W TSE sequence had an accuracy of 100% in detecting abscesses. Thus, MRI can be considered an accurate tool for the preoperative evaluation of fistula-in-ano. Both T2W TSE and post-contrast FS T1W TSE sequences are highly accurate in depicting the features of fistula-in-ano. If there are no contraindications, contrast administration is recommended to differentiate abscesses from active inflammation.[19]

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. To compare the predictability of different MRI sequences

2. To evaluate the role of MRI in the assessment of perianal fistula and its correlation with per operative findings.

7.0 MATERIALS AND METHODS:

7.1 SOURCE OF DATA

This prospective study will be conducted from 15 September 2022 to 15 March 2024 on patients referred for MRI perineum to the department of Radio-diagnosis, Dayanand medical college & hospital, Ludhiana.

7.2 METHOD OF COLLECTION OF DATA

All patients detected with a perianal fistula on Magnetic Resonance Imaging (MRI) will be included in the study. Consent will be obtained from each patient and a relevant detailed history will be elicited. Findings of general physical and systemic examination will be recorded. Before conducting the study, the procedure will be explained to the patient in his/her vernacular language to allay the anxiety and fear. A contrast study will be done in MR wherever indicated.

Inclusion Criteria

1. Patients diagnosed/ suspicious of perianal fistula.
2. Previously operated cases requiring revision surgery.

Exclusion Criterion

1. Patients with underlying inflammatory conditions/ autoimmune disease
2. Patients who refuse to participate in the study
3. Uncooperative patients
4. Patients with metallic implants and other contraindications to MRI

MR imaging technique

MR imaging will be performed on a 3T unit (Magnetom Skyra, Siemens, Germany.) using sequencesT1 TSE Axial, T2 TSE Axial, T2 TSE Saggital, T2 TSE Coronal, DWI, T1 Post Contrast FS Axial, T1 post contrast FS Coronal, T1 post contrast FS Saggital and T2 FS axial.

Sequence	T1 TSE Axial	T2 TSE Axial	T2 TSE Saggital	T2 TSE Coronal	DWI	T1 Post Contrast FS Axial	T1 post contrast FS Coronal	T1 post contrast FS Saggital	T2 FS axial
Acquisition Time	2.30min	2.40min	3.10 min	2.50 min	3.20 min	2.30 min	3.000min	2.40 min	3.00min
Orientation	Transverse	Transverse	Saggital	coronal	Transverse	Transverse	coronal	Saggital	Transverse
Resolution Matrix	320	384	320	384	114	320	320	320	384
No. of slices	30	30	25	30	30	30	30	30	30
FoV Read(mm)	220	220	230	230	220	220	220	220	220
FoV phase (%)	100	100	100	100	100	100	100	100	100
Slice thickness(mm)	3mm	3mm	3mm	3mm	3mm	3mm	3mm	3mm	3mm
Slice Gap(mm)	1mm	1mm	1mm	1mm	1mm	1mm	1mm	1mm	1mm
Repitition Time(msec)	680msec	3100msec	2800msec	2800msec	4000msec	680msec	630msec	630msec	3120msec
TE(msec)	18msec	89msec	86msec	87msec	64msec	18msec	20msec	20msec/1000msec	89msec
Flip Angle	150	150	150	150	-	150	150	150	150
Flow Compression	Raed	Slice	No	No	-	Read	No	Read	Slice

DURATION OF STUDY- One and half year (15 September 2022 to 15 March 2024)

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. For comparing categorical data, Chi square ($\chi 2$) test was performed and fisher exact test was used when the expected frequency is less than 5. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value will also be calculated. A probability value (p value) less than 0.05 will be considered statistically significant. All statistical calculations will be done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

OUTCOME: Using variour MRI sequences the data will be obtained & findings will be analysed.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Yes, Attached herewith.

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PROFORMA

Sr. No.

NAME- DATE-

AGE- CASE NUMBER-

GENDER-

MRD NUMBER-

CONTACT NUMBER-

CLINICAL HISTORY:

- Pain in perianal region-
- Swelling-
- Itching-
- Discharge-
- Fever-
- Other-

LAB FINDINGS:

- CBC
  - -Hb
  - - WBC
  - - Platelet
- CRP-
- ESR-
- S.Creat-

Signature of Candidate **Signature of Supervisor**

Clinical Examination:

1. Swelling in perianal region

2. Discharge

3. Tenderness

4. Site of External opening

5. No. of external openings

6. Other findings

MRI Findings:

(A) Primary fistulous tract-

1.Grade

2.External opening

3.Internal opening

5. Distance of internal opening from anal verge

6. Distance of external opening from anal verge

7.Wall enhancement

(B) Secondary fistulous tract and ramifications

1. Number

2. Grade

3. Horseshoe component

(C) Supra levator extension

(D) Abscess

1.Number

2.Wall enhancement

3.Surrounding inflammation

(E) Impression:

Signature of Candidate **Signature of Supervisor**

Comparison of different MRI sequences:

	DWI	T1 Post Contrast FS	T2	T2 FS
Primary fistulous tract				
External opening				
Internal opening				
Secondary tract and ramifications				
Horseshoe component(yes/no)				
Supraelevator extension				
Abscess				

Intraoperative Findings-

1. Number of perianal fistula
2. Type of perianal fistula
3. External opening
4. Internal opening
5. Distance of internal opening from anal verge
6. Secondary fistulous tract number
7. Horseshoe component(yes/no)
8. Supra levator extension
9. Abscess+/-

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I……..D/o,W/o,S/o…… ……. ……am willing to participate in the study **"ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

……	……
Signature of the Witness	Signature of the patient
Name:	

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____ इस शोधकार्य "**ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA**" में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक केहस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____ ਵਾਸੀ _____ "**ROLE OF MRI IN ASSESSMENT OF PERIANAL FISTULA**" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾਮਨੇਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ–ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

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ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

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ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

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ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ